INSTRUCTION MANUAL

REGULATED POWER SUPPLIES

MODEL LM

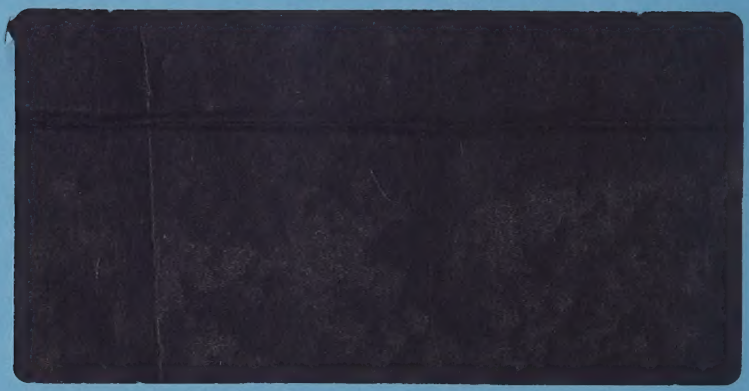
F PACKAGE

THIS MANUAL APPLIES TO UNITS

BEARING SERIAL NO. PREFIXES A-F

LAMBDA

LAMBDA ELECTRONICS MELVILLE, L. I., N. Y.



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This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics

LAMBDA ELECTRONICS MELVILLE, L.I., N.Y.

MAIN PLANT TELEPHONE: 516 MYrtle 4-4200

TABLE OF CONTENTS

SECTION	PAGE
SPECIFICATIONS AND FEATURES	1
Mounting	2
Model Options	2
THEORY OF OPERATION	3
General	3
Functional Description	3
Overvoltage Protector Circuit, Functional Description	3
OPERATING INSTRUCTIONS	5
Basic Mode of Operation	5
Connections for Operation	5
Operation After Protective Device Shutdown	5
MAINTENANCE	7
General	7
Trouble Analysis	7
Checking Transistors and Capacitors	7
Printed Circuit Board Maintenance Techniques	7
Trouble Chart	8
Performance Check	9
Adjustment of Calibration Control R17	9
Adjustment of OV ADJ Control OV-R1	10
SERVICE	12
PARTS ORDERING	12
PARTS LIST	F-1

SPECIFICATIONS AND FEATURES

The following specifications apply for all Lambda F package LM power supplies. Specification exceptions noted here relate to models incorporating model option "Y" and/or "T". Performance specifications do not change for models with suffix "R", e.g., LM-F4-R unless the models also include model options "Y" and/or "T" e.g., LM-F4-YR; for these models the appropriate specification exceptions also apply.

NOTE: Specifications in italics apply only for Lambda models with a "Y" suffix, e.g., LM-F4-Y. AC INPUT specification with an asterisk*, applies only for Lambda models with a "T" or "V" suffix, e.g., LM-F4-YT.

DC OUTPUT--Voltage regulated for line and load

Voltage Range.... For voltage range see table I of pertinent model group.

Multi-Current Ratings.... Current ratings specified for each maximum ambient temperature apply over entire output voltage range, with input frequency 55-65 cps. For input frequencies 45-55 at 105-132 VAC, 200-250 VAC or 205-265 VAC, delete 40°C current rating.

For input frequencies 360-440 cps, consult factory for current ratings.

For maximum current ratings at each ambient temperature see table I of pertinent model group.

REGULATED VOLTAGE OUTPUT

Regulation (line)... Less than 0.05 percent plus 4.0 millivolts for input variations from 105-132 or 132-105 volts AC

... Less than 0.01 percent plus 1.0 millivolt for input variations from 105-132 or 132-105 volts AC

Regulation (load)... Less than 0.03 percent plus 3.0 millivolts for load variations from 0 to full load or full load to 0

... Less than 0.02 percent plus 2.0 millivolts for load variations from 0 to full load or full load to 0

Remote Programming

External Resistor... Nominal 200 ohms/volt output

Programming Voltage... One-to-one voltage change

Ripple... One millivolt rms; 3 millivolts peak-to-peak with 45-65 cps input

... One millivolt rms; 15 millivolts peak-to-peak with 360-440 cps input

...0.5 millivolt rms; 1.5 millivolts peak-to-peak with 45-65 cps input

Temperature Coefficient... Change in output voltage less than 0.03%/°C

... Change in output voltage less than 0.01%/°C

AC INPUT--105-132 volts AC at 45-440 cps; 900 watts+

\+ With output loaded to full 40°C rating and input voltage 132 volts at 55-65 cps.

*... 200-250 volts AC at 45-440 cps ("T" option)

*... 205-265 or 187-242 volts AC at 45-440 cps ("V" option)

INPUT FUSE-- Fuse F1 protects the AC input circuit. Overload of the supply does not cause fuse failure.

OVERLOAD PROTECTION

Thermal.... Thermostat resets automatically when overtemperature condition is eliminated

Electrical... Within rated voltage range, an automatic electronic current-limiting circuit limits output current to approximately 110 percent of 40°C rated current for protection of load and power supply; for overloads approaching short circuit, both voltage and current decrease until at short circuit, current is reduced to a safe value, except for model LMF-0-7 where output current remains limited to approximately 110 percent of 40°C current rating.

OVERSHOOT--No overshoot of output voltage under conditions of power turn-on, power turn-off, or power failure.

INPUT AND OUTPUT CONNECTIONS--Heavy duty terminal block on rear of chassis

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE-- Continuous duty from -20°C to 71°C ambient with corresponding load current ratings for all modes of operation.

STORAGE TEMPERATURE-- -55°C to +85°C

METERS--Voltmeter and ammeter monitor the voltage and load output current respectively on metered (M) models.

CONTROLS

DC output control... VOLT ADJ. control on front panel of all units permits adjustment of DC output voltage.

Overvoltage Control... On units with overvoltage circuit, OV ADJ control permits setting of the overvoltage protection point.

Power... Panel-mounted magnetic circuit breaker on "OV" suffix models or power-on switch on all other models and indicator light. The circuit breaker or switch controls application of input power to the supply. Overvoltage condition causes the breaker to trip. When the breaker or switch is in the ON position the red ON indicator lamp glows.

REMOTE SENSING--Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

PHYSICAL DATA

Size.....3-15/32" H x 19" W x 16-1/2" D

Weight.....54 lbs. net; 64 lbs. shipping wt.

Panel Finish..... Brushed aluminum clear anodized panels with grey inlay (Standard); special finishes available to customer's specifications at moderate surcharge.

MOUNTING--Standard 19" rack mounting.

MODEL OPTIONS

Suffix "T" Input Option... Standard LM power supplies are available for operation with 200-250 volt, 45-440 cps input.

Suffix "Y" High Performance Option... All Lambda LM power supplies are available with high performance specifications. See italicized entries under SPECIFICATIONS AND FEATURES.

Suffix "R" Fungus Proofing Option... Standard LM power supplies can be obtained with fungus proofing treatment with MIL V 173 varnish for all fungi nutrient components.

Suffix "M" Meter Option... All Lambda LM power supplies are available with voltmeter and ammeter.

Suffix "OV" Overvoltage Protection Option... LM-F power supplies are available with a built-in overvoltage protection circuit which prevents damage to the load that can be caused by excessive power supply output voltage.

Suffix "V" Input Option... Standard LM power supplies are available for operation with 205-265 volt, 45-440 cps input or 187-242 volt, 45-440 cps input. See nameplate for AC input rating. See schematic diagram for rewiring of AC input.

Suffix "S" or "SP" Option (LM-F3 through LM-F60 and LMF-0-7 Only)... Suffix "OV" LM-F power supplies are available for use with Lambda Systems Power Sequencer (suffix "S") or Systems Power Protector (suffix "SP")

THEORY OF OPERATION

GENERAL

The Lambda power supply consists of an AC input circuit and transformer; a bias supply consisting of an auxiliary rectifier, filter, and a zener diode regulator; a drive supply* consisting of a rectifier and filter; and a main regulator circuit consisting of the main rectifier and filter, a series regulator, emitter follower drivers, an error amplifier, a current limit amplifier, an output voltage sensing circuit and an output current sensing resistor. In addition a fault protector circuit* is provided and as applicable a voltage amplifier.

*This circuit not used in Models LM-F60, LM-F100, LM-F120, LM-F150

The circuit arrangement is shown in block diagram form in figure 7. The circuitry is discussed with reference to the block diagram and the schematic diagram.

FUNCTIONAL DESCRIPTION

Single phase input power is applied to transformer T1 through the input circuit containing thermostat S1, which protects the supply against overheating.

The main rectifier, a full-wave rectifier, provides the power which is filtered and then regulated via a series regulator and delivered to the output. Bias supply, half-wave, auxiliary rectifier CR7, provides voltage filtered by capacitor C7 and regulated by zener diode CR6 for current limit amplifier Q3, fault protector Q7 and error amplifier Q1, Q2 (or for voltage amplifier Q2). Zener diode CR1 and resistor R5, across the bias supply provide a regulated temperature compensated reference voltage. Resistor R4 compensates for input voltage variations. As applicable, the drive supply, a full-wave rectifier, provides voltage for drivers Q5, Q6.

Operation of the voltage regulator circuit is determined by changes in the output voltage. A change in the output voltage is sensed by the sensing divider resistors which compare output voltage with the +S reference voltage. This provides an error voltage at junction of R2 and R3, (or as applicable R1 and R3) which is amplified by error amplifier Q1, and Q2 (and as applicable by voltage amplifier Q2) and is current amplified by drivers Q5, Q6 (and as applicable Q8, Q9). The amplified signal from the drivers controls the voltage across the series regulator transistors, which function as the active regulating element, restoring output voltage to the proper level.

*Current limit circuit operation is determined by changes in the load. Current limit amplifier Q3 samples load current through current sensing resistor R25A. When the voltage drop across R25A increases compared with the preset voltage reference determined by R17 and R18, Q3 conducts. Thus, when the output current rating of the unit is exceeded, current limit amplifier Q3 conducts, decreasing the current through drivers Q5, Q6, (and as applicable Q8, Q9) resulting in an increase of voltage across the series regulator and a decrease of the output voltage, effectively limiting the output current to a safe value. The current limit value is determined by the factory setting of current limit potentiometer R17.

When operating conditions approach short circuit, the output voltage decreases. Since the voltage determined by R17 and R18 is proportional to the output voltage, when the output voltage decreases, Q3 is biased into turn-on at lower and lower load currents until output voltage decreases to zero and current decreases to a predetermined low value.

*The following paragraph only applies for model LMF-0-7 with voltage amplifier Q2.

Current limit circuit operation is determined by changes in the load. When load current increases above the rated current value, the voltage drop across current limit potentiometer R17 increases, turning on current limit amplifier Q3. With Q3 conducting, the current to drivers Q5, Q6 is limited, in turn limiting the base current to the series regulator which results in an increase of voltage across the series regulator and a decrease of the output voltage, effectively limiting the output current to a safe value. The current limit value is determined by the factory setting of current limit potentiometer R17. When operating conditions reach short circuit, the output voltage value decreases to zero and the current is limited to a predetermined current limit value and remains unchanged.

During normal operation of the supply, with no faults occurring, fault protector transistor Q7 is at cutoff and not conducting. When an operation malfunction occurs because of open sense leads or improper series regulator operation, increased current through R39 causes Q7 to be biased on. With Q7 conducting, drive current is diverted from drivers Q5, Q6 and from the series regulator through fault protector Q7, thereby protecting these transistors from damage that can be caused by excessive drive current.

OVERVOLTAGE PROTECTOR CIRCUIT, FUNCTIONAL DESCRIPTION

Divider network OV-R1, OV-R2, OV-R3, OV-R4 and OV-R7 attenuates the power supply output voltage. When the power supply output voltage increases above the overvoltage limit set by OV ADJ control OV-R1, the attenuated voltage of the divider network also increases, biasing transistor OV-Q1 on. OV-Q1, in turn, biases OV-Q2 on through resistor OV-R10. OV-Q2 supplies gate current to OV-SCR-1, turning it on, driving current through the breaker trip coil and into the gate of SCR-71, turning SCR-71 on. This, in turn, causes the voltage at the power supply terminals to drop, protecting the load from excessive supply output voltage. OV-SCR-1 and SCR-71 conduct until the circuit breaker trips, causing power to the power supply to be cut off.

CAUTION

The overvoltage protector will <u>not</u> provide protection against overvoltage conditions caused by storage batteries or other power sources used in conjunction with the Lambda power supply. Whenever additional power sources must be used with the Lambda power supply and overvoltage protector combination, consult the factory for proper installation information.

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40°C. For continuous operation, load current must not exceed the rating for each ambient temperature. When load current exceeds 110% of 40°C rating, both voltage and current decrease until voltage reaches zero and the current at short circuit equals approximately 40 percent of the rated current, except for model LMF-0-7, where output current remains limited to approximately 110% of 40°C current rating.

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying AC input power.

Ground Connections. The Lambda power supply can be operated either with negative or positive output terminal grounded. Both positive and negative ground connections are shown in the diagrams for all suggested output connections illustrated in this manual.

Connection Terminals. Make all connections to the supply at the terminal block on the rear of the supply. Apply input power to terminals 1 and 2; always connect the ungrounded (hot) lead to terminal 1.

The supply positive terminal is brought out to terminal 6; the negative terminal to terminal 4.

NOTE: When shipped from the factory, the supply is ready for use as a local-sensing constant voltage source. Jumpers are connected at the factory as shown in figure 3. Take care to remove the appropriate jumpers for load requirements that need different supply-load connections. Refer to the appropriate connection diagram.

Supply-Load Connections. The regulation of the supply at the load may change when connecting leads of practical length are used. To minimize the effect of the output load leads, remote sensing is used. Refer to figure 1 to determine voltage drop for particular cable lengths, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Local-Sensing Connection, See Figure 3.

Remote-Sensing Connection, See Figure 4.

NOTE: For all models except LMF-0-7, whenever the supply is connected for remote sensing, the total voltage drop across both load leads must not exceed the 5 percent output voltage band width of the power supply.

Programmed Voltage Connection Using External Resistor, See Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at nominal 200 ohms/volt output and a shorting-type switch. For continuous voltage variations, use a variable resistor with the same ohms/volt ratio in place of the voltage divider and shorting-type switch. Use low temperature coefficient resistor(s) to assure most stable operation.

Programmed Voltage Connection Using Programming Voltage, See Figure 6. The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply.

The programming supply must have a reverse current capability of 6 ma. minimum.

Alternatively, when supplies with less than 6 ma. reverse current capability are used, a resistor capable of drawing 6 ma. at the minimum programming voltage must be connected across the output terminals of the supply. This programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown

The thermostat opens the input circuit only when the power supply output current exceeds the current rating specified for the operating ambient temperature causing the temperature of the transistor heat radiator to exceed a maximum safe value. The thermostat will automatically reset when the temperature of the radiator decreases to safe operating value. After eliminating the cause(s) for overheating and allowing time for the power supply to cool to a proper temperature, resume operation of the supply.

Fuse Shutdown

Internal component failure is prevented by a fuse which protects components from damage caused by excessive currents. The fuse will blow when the maximum rated current value for the fuse is exceeded. Fatigue failure of the fuse can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative.

Circuit-Breaker Shutdown (For "OV" Suffix Models Only)

The ON-OFF circuit breaker controls application of input power to all Model LM-F power supplies with built in overvoltage protection. When the power supply output voltage increases above the preset overvoltage limit, the breaker trips, opening the input circuit, causing the ON-OFF indicator to extinguish. After eliminating the cause(s) for overvoltage, resume operation of the supply.

MAINTENANCE

GENERAL

This section describes trouble analysis routine, calibration and test procedures that are useful for servicing the Lambda power supply. A trouble chart is provided as an aid for the troubleshooter. Refer to the section on specifications and features for the minimum performance standards.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check all fuses, primary power lines, external circuit elements, and external wiring for malfunction before trouble shooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumpers and supply-load connections or fuse failure due to metal fatigue.

Use the electrical schematic diagram and block diagram, figure 7, as an aid to locating trouble causes. The schematic diagram contains various circuit voltages that are averages for normal no load operation. Measure these voltages using the conditions for measurement specified on the schematic diagram. Use measuring probes carefully to avoid causing short circuits and damaging circuit components.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an in-circuit transistor checker. If no checker is available, transistors can be checked with an ohmmeter that has a highly limited current capability. Observe proper polarity for PNP or NPN to avoid error in measurement. The forward transistor resistance is low but never ZERO; backward resistance is always higher than the forward resistance.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning power on, before checking for additional faulty components could damage the replaced component.

When soldering semi-conductor devices, hold the lead being soldered with a pair of pliers or a commercial heat sink device placed between the component and the solder joint.

> NOTE: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In all cases the capacitors are shunted with resistances, some of which have low values. Only a dead short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil is intact but not covered with solder it is a good contact. Do not attempt to cover with solder.

2. Voltage measurements can be made from either side of the board. Use a needle-point probe to penetrate to the wiring whenever a protective coating is used on the wiring. A brass probe can be soldered to an alligator clip adapted to measuring instrument.

3. Always use a heat sink when soldering transistors; a transistor pad with mounting feet is an effective heat sink.

4. Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering. To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.

5. When unsoldering components from the board never pry or force loose the part; unsolder the component by using the wicking process described below:

   (a) Select a 3/16 inch tinned copper braid for use as a wick; if braid is not available, select AWG No. 14 or No. 16 stranded wire with 1/2 inch insulation removed.

   (b) Dip the wick in liquid rosin flux.

(c) Place the wick onto the soldered connection and apply soldering iron onto the wick.

(d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick.

TROUBLE CHART

The trouble chart is intended as a guide for locating trouble causes, and is used along with the schematic diagram.

The operating conditions assumed for the trouble chart are as follows:

(a) AC power of proper voltage and frequency is present at input terminals.

(b) Either positive or negative terminal is connected to chassis ground.

(c) The power supply is connected for constant voltage with local sensing. See schematic; dotted lines indicate jumpers connected for local sensing operation.

TROUBLE CHART

Sympton	Probable Cause	Remedy
1. No output voltage	No power input, thermostat S1 open	Check power source, S1, line cord and line cord plug; shut off unit, allow to cool and check ambient temperature
	Improper output terminal connection	Refer to appropriate connection diagram, and check for correct connections
	Faulty Q2, Q3, CR1, CR6	Check Q2, Q3, CR1, CR6 for short and replace as required
2. Unable to adjust output voltage	Damaged VOLTAGE ADJUST control	Check R1 for shorts and/or open: replace as required
	Supply operating as constant current source at current limit value	Remove load, check load value and check for shorts and/or improper supply-load connections; refer to appropriate diagram for correct connections
3. Output voltage too high	Improper output terminal connection	Refer to appropriate connection diagram, and check for correct connections
On OV units, breaker trips and cannot be reset	Improper adjustment of OV ADJ control	Refer to procedure for adjusting OV ADJ control and reset control
	Faulty Q1, R1, Q10-Q18, Q5, Q6 (and Q8, Q9 as applicable) or CR1	Check R1 for open; Q10-Q18, Q5, Q6, (Q8, Q9), Q1 for short; CR1 for open and replace as required
	OV-Q1, OV-Q2, OV-SCR 1 on OV subassembly faulty (least probable fault cause)	Check OV-Q1, OV-Q2, OV-SCR 1 for short and replace as required
4. Output voltage too low	Load resistance improper for unit ratings	Check load resistance value
	Faulty Q2, Q3, R25A, R17	Check Q2, Q3 for short, R25A R17 for open, replace as required

TROUBLE CHART (Cont'd)

Symptom	Probable Cause	Remedy
4. (Cont'd)		
Output voltage too low on units with OV option	Faulty SCR 71 in OV circuit (least probable fault cause)	Remove cathode connection to SCR 71 and reapply power, if output is restored SCR 71 is faulty; replace SCR 71
5. High ripple and unregulated DC output	Load resistance improper for unit ratings	Check load resistance value
6. High ripple	Improper ground	Connect terminal 6 or terminal 4 to ground terminal 5

PERFORMANCE CHECK

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 8. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC VTVM (John Fluke Model 825A or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the full load to no-load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 105-132 or 132-105 volts AC and check the power supply line regulation accuracy on the VTVM differential meter.

Use a VTVM, Ballantine 320 or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output.

ADJUSTMENT OF CALIBRATION CONTROL R17

The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C and has not been operated with load for at least one hour.

Whenever Q3, R25A or R17 are replaced, and voltage and current indications do not reflect maximum ratings, adjust R17 as follows:

1. Remove AC power input to the supply.
2. Unsolder wiper of R17 from resistor housing and turn to full CW position.
3. Operate power supply for constant voltage with local sensign, connected as shown in figure 3, with no external load.
4. * Turn voltage adjust control until minimum rated output voltage is obtained.
5. * Apply load so that output current is 110% of 40°C rating for the unit.
6. * Using an oscilloscope, Tektronix 503 or equivalent, observe output voltage while adjusting R17 in a CCW direction. Adjust R17 until output ripple increases sharply and oscilloscope pattern changes.
7. * After adjustment is completed, remove AC power input to the supply and solder wiper of R17 to resistor housing.
8. * After soldering, check setting and repeat adjustment procedure if required.

* Perform alternate steps 4A through 8A for adjustment of R17 on model LMF-0-7.

4A. Turn voltage adjust control until rated output voltage is obtained.

5A. Apply load so that output current is 120% of 40°C rating for the unit.

6A. Using an oscilloscope, Tektronix 503 or equivalent, observe unit output voltage while adjusting R17 in a CCW direction. Adjust R17 until output ripple increases sharply and oscilloscope pattern changes.

7A. After adjustment is completed, remove AC power input to the supply and solder wiper of R17 to resistor housing.

8A. After soldering, check setting and repeat adjustment procedure if required.

ADJUSTMENT OF OV ADJ CONTROL OV-R1

Adjust the voltage-protection point of overvoltage protector circuit as follows:

1. Turn OV ADJ control on front panel fully clockwise.

2. The recommended voltage-protection point is 115% of normal power supply operation voltage plus one volt. Compute this value for the operation voltage being used.

3. Turn on the power supply, and raise the output voltage to the desired voltage-protection point; monitor the power supply output voltage to assure correct voltage. If the power supply does not have an adequate adjustment range omit steps 4 and 5, and continue with step 6 below.

4. Slowly turn the OV ADJ control counterclockwise until the circuit breaker trips, indicating that the voltage protection point is reached.

5. The voltage-protection point is now set. Reduce power supply output voltage setting before re-applying input power.

6. If the power supply output voltage adjustment range does not extend to the protection-point voltage computed in step 2, proceed as follows:

   a) Turn on power supply and raise output voltage to the normal operating voltage.

   b) Slowly turn the OV ADJ control counterclockwise until the circuit breaker trips.

   c) Refer to chart below, select appropriate volts/turn ratio, and turn OV ADJ control clockwise by the number of turns equivalent to 1 volt plus 15% of the operating voltage.

MODEL	VOLTS/TURN	OVERVOLTAGE ADJUSTMENT RANGE
LM-F2, F3, F3P3, F3P6, F4, F4P5, F5, F6	0.3	3 - 8v
LM-F8, F10, F12, F15	0.8	6 - 20v
LM-F18, F20, F24, F28, F36, F48, F60	2.7	18 - 79v

For Example:

When using power supply LM-F5-OV with output voltage setting of 5 volts, calculate as follows:

$$T = \frac{1 + .15\ (OV)}{V/T}$$

where

T = turns of OV ADJ control

OV = operating voltage of power supply

V/T = volts/turn ratio from chart

$$T = \frac{1 + .15(5)}{0.3} = 5.8$$

Rotate OV ADJ control 5.8 turns in clockwise direction to obtain a voltage setting 1.8 volts above the 5-volt power supply setting, or 6.8 volts.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest Lambda office where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information, Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.
2. Lambda part number.
3. Description of part together with circuit designation.
4. If part is not an electronic part, or is not listed, provide a description, function, and location of the part.

PARTS LIST

The electrical parts located on all LM-F models are listed here. Parts common to a group of LM-F models are listed first. Unique parts of individual models within the group are listed separately, by model, immediately following the group common-parts listing. In addition there are separate listings of parts for the metered panel (M) option, the Y option and the overvoltage protection (OV) option, as applicable, for all LM-F models. The parts listed for models LM-F60 and LMF-0-7, do not utilize the common parts-unique parts listings; all the parts for these models are sequentially listed under the applicable heading "PARTS FOR MODEL". Parts for the T option , V option, and R option are included at the end of this listing.

MODELS LM-F2 — LM-F10

COMMON PARTS

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
C1	Cap., mylar, 0.033 mfd ±10%, 400 vdc	CGL33-009
C2	Cap., mylar, 0.22 mfd ±10%, 80 vdc	CGM22-004
C3	Cap., elect., 25,000 mfd -10% +100%, 20 vdc	CBT25-011
C4	Cap., elect., 3.0 mfd -10% +75%, 100 vdc	CBN30-015
C5	Cap., mylar, 0.018 mfd ±10%, 200 vdc	CGL18-005
C6	Same as C5	
C7	Cap., elect., 140 mfd -10% +100%, 38 vdc	CBR14-030
C8	Not used	
C9	Cap., paper, 1.0 mfd ±20%, 200 vdc	CAN10-024
C10	Same as C9	
C11	Same as C9	
C12 Thru C14	Not used	
C15	Cap., elect., 3,600 mfd -10% +100%, 20 vdc	CBS36-044
C16, C17	Cap., mylar, 0.068 mfd ±10%, 200 vdc	CGL68-003
C18 Thru C20	Same as C3	
C21 Thru C24	Not used	
C25	Same as C2	
C26 Thru C29	Not used	
C30	Cap., mylar, 0.022 mfd ±10%, 200 vdc	CGL22-001
C31	Same as C4	
C32 thru C37	Not used	
C38++	Cap., mylar, 0.033 mf ±10%, 400 vdc	CGL-33-009
CR1+	Rectifier, zener diode	FBM-Z104
CR2	Rectifier	FBL00-030

MODELS LM-F2 — LM-F10 (Cont)

COMMON PARTS (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
CR3	Same as CR2	
CR4	Not used	
CR5	Not used	
CR6	Rectifier, zener diode	FBM-Z103
CR7	Same as CR2	
CR9	Not used	
CR11 Thru CR15	Not used	
CR16	Rectifier	FBL00-047
CR17	Same as CR16	
DS1**	Lamp assembly	HRD00-003
DS1	Lamp assembly	HRD00-021
M2*	Ammeter, 0-50 amperes	EDP50-017
Q1	Transistor, NPN	FBN-L110
Q2	Same as Q1	
Q3	Same as Q1	
Q4	Not used	
Q5	Transistor, NPN	FBN-L113
Q6	Transistor, NPN	FBN36485
Q7	Same as Q1	
Q8	Not used	
Q9	Not used	
Q10	Transistor, NPN	FBN-36972
Q11 Thru Q18	Same as Q10	
R3	Res., ww, 1,200 ohms ±3%, 2w	DFS12-030
R4+	Res., film, 15,000 ohms ±2%, 1/2w	DCT15-013
R5	Res., film, 220 ohms ±2%, 1/2w	DCR22-005
R6	Res., comp., 180,000 ohms ±10%, 1/2w	DEB1841
R7	Res., film, 3,900 ohms ±5%, 1/2w	DCS39-014
R8	Res., comp., 4,700 ohms ±10%, 1/2w	DEB4721
R9	Res., comp., 150 ohms ±10%, 1/4w	DCB1511

COMMON PARTS (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
R10	Res., comp., 2,200 ohms ±10%, 1/2w	DEB2221
R11	Res., comp., 22,000 ohms ±10%, 1/2w	DEB2231
R12	Res., comp., 47 ohms ±10%, 1/2w	DEB4701
R13+	Res., ww, 600 ohms ±3%, 3w	DFR60-005
R14	Not used	
R15	Not used	
R16	Res., comp., 560 ohms ±10%, 1/2w	DEB5611
R17	Res., var., ww, 1,200 ohms ±10%, 1-1/2w	DNS12-026
R19 Thru R21	Not used	
R22	Res., comp., 150 ohms ±10%, 1/2w	DEB1511
R23	Res., comp., 15 ohms ±10%, 1/2w	DEB-1501
R25A, B Thru R29A, B	Res., ww, tapped, two sections, 0.18 ohms +5%/ section, 11w/section	DFM-36-049
R30 Thru R37	Not used	
R38	Res., comp., 330 ohms ±10%, 1/2w	DEB3311
R39	Res., ww, 0.17 ohm ±5%, 3w	DFM17-052
R40	Res., comp., 470 ohms ±10%, 2w	DHB4711
R41	Meter shunt, 50 amperes	ESP50-002
R42	Res., comp., 33 ohms ±10%, 1/2w	DEB3301
S1	Thermostat	FKA137-014
S2	Switch, SPST, breaker type, no coil (not used on units with "OV" option)	FHC00-003-0
XF1	Fuseholder	HRM-00-013

* This part only used on units with "M" meter option
** This part only used on units with serial no. prefix A.
\+ This component not used on units with "Y" option
++ C38 not used on units with serial number prefixes A-D.

UNIQUE PARTS

MODEL LM-F2

CR8, CR10	Rectifier	FBL-00-122
F1	Fuse, 15A	FFP-15-000
M1*	Meter, volts, D.C. 0-5 vdc full scale	EBN-50-003
R1	Res., var., ww, 300 ohms ±5%, 5 w	DNR-30-018
R2	Res., ww, 250 ohms ±3%, 3w	DFR-25-003
R18	Not used	
R24	Res., film, 68 ohms ±10%, 2w	DCP-68-004
T1	Transformer	ABA-F2

*This part only used on units with "M" meter option.

MODEL LM-F3

CR8	Rectifier	FBL-00-122
CR10	Same as CR8	
F1	Fuse, 15A	FFP-15-000
M1*	Meter, volts, D.C., 0-5 vdc full scale	EBN-50-003
R1	Res., var., ww, 300 ohms ±5%, 5w	DNR-30-018
R2	Res., ww, 430 ohms ±3%, 3w	DFR-43-058
R18	Not used	

MODEL LM-F3 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
R24	Res., film, 68 ohms ±10%, 2w	DCP-68-004
T1	Transformer	ABA-F3P6

*This part only used on units with "M" meter option.

MODEL LM-F3P3

CR8	Rectifier	FBL-00-122
CR10	Same as CR8	
F1	Fuse, 15A	FFP-15-000
M1*	Meter, volts, D.C., 0-5 vdc full scale	EBN-50-003
R1	Res., var., ww, 600 ohms ±5%, 5w	DNR-60-026
R2	Res., ww, 430 ohms ±3%, 3w	DFR-43-058
R18	Not used	
R24	Res., film, 68 ohms ±10%, 2w	DCP-68-004
T1	Transformer	ABA-F3P6

*This part only used on units with "M" meter option.

MODEL LM-F3P6

CR8	Rectifier	FBL-00-122
CR10	Same as CR8	
F1	Fuse, 15A	FFP-15-000
M1*	Meter, volts, D.C., 0-5 vdc full scale	EBN-50-003
R1	Res., var., ww, 600 ohms ±5%, 5w	DNR-60-026
R2	Res., ww, 430 ohms ±3%, 3w	DFR-43-058
R18	Not used	
R24	Res., film, 68 ohms ±10%, 2w	DCP-68-004
T1	Transformer	ABA-F3P6

*This part only used on units with "M" meter option.

MODEL LM-F4

CR8	Rectifier	FBL-00-122
CR10	Same as CR8	
F1	Fuse, 15A	FFP-15-000
M1*	Meter, volts, D.C., 0-5 vdc full scale	EBN-50-003
R1	Res., var., ww, 600 ohms ±5%, 5w	DNR-60-026
R2	Res., ww, 600 ohms ±3%, 3w	DFR-60-005
R18	Not used	
R24	Res., film, 68 ohms ±10%, 2w	DCP-68-004
T1	Transformer	ABA-F4P5

*This part only used on units with "M" meter option.

MODEL LM-F4P5

CR8	Rectifier	FBL-00-122
CR10	Same as CR8	
F1	Fuse, 15A	FFP-15-000
M1*	Meter, volts, D.C., 0-5 vdc full scale	EBN-50-003
R1	Res., var., ww, 600 ohms ±5%, 5w	DNR-60-026
R2	Res., ww, 650 ohms ±3%, 3w	DFR-65-062
R18	Res., film, 390 ohms ±5%, 1/2w	DCR-39-004
R24	Res., film, 68 ohms ±10%, 2w	DCP-68-004
T1	Transformer	ABA-F4P5

*This part only used on units with "M" meter option.

UNIQUE PARTS (Cont)

MODEL LM-F5

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
CR8	Rectifier,	FBL-00-122
CR10	Same as CR8	
F1	Fuse, 20A	FFP-20-000
M1*	Meter, volts, D.C., 0-8 vdc full scale	EBN-80-005
R1	Res., var., ww, 600 ohms ±5%, 5w	DNR-60-026
R2	Res., ww, 650 ohms ±3%, 3w	DFR-65-062
R18	Res., film, 1,300 ohms ±5%, 1/2w	DCS-13-010
R24	Res., film, 68 ohms ±10%, 2w	DCP-68-004
T1	Transformer	ABA-F4P5

*This part only used on units with "M" meter option

MODEL LM-F6

CR8	Rectifier	FBL-00-122
CR10	Same as CR8	
F1	Fuse, 20A	FFP-20-000
M1*	Meter, volts, D.C., 0-8 vdc full scale	EBN-80-005
R1	Res., var., ww, 600 ohms ±5%, 5w	DNR-60-026
R2	Res., ww, 800 ohms ±3%, 3w	DFR-80-037
R18	Res., film, 1,300 ohms ±5%, 1/2w	DCS-13-010
R24	Res., film, 180 ohms ±10%, 2w	DCR-18-012
T1	Transformer	ABA-F6

*This part only used on units with "M" meter option.

MODEL LM-F8

CR8	Rectifier	FBL-00-059
CR10	Same as CR8	
F1	Fuse, 20A	FFP-20-000
M1*	Meter, volts, D.C., 0-10 vdc full scale	EBP-10-016
R1	Res., var., ww, 1,000 ohms ±5%, 5w	DNS-10-032
R2	Res., ww, 1,200 ohms ±3%, 2w	DFS-12-030
R18	Res., film, 2,400 ohms ±5%, 1/2w	DCS-24-001
R24	Res., film, 180 ohms ±10%, 2w	DCR-18-012
T1	Transformer	ABA-F8

*This part only used on units with "M" meter option.

MODEL LM-F10

CR8	Rectifier	FBL-00-059
CR10	Same as CR8	
F1	Fuse, 20A	FFP-20-000
M1*	Meter, volts, D.C., 0-15 vdc full scale	EBP-15-017
R1	Res., var., ww, 2,200 ohms ±5%, 5w	DNS-22-053
R2	Res., ww, 1,200 ohms ±3%, 2w	DFS-12-030
R18	Res., film, 2,400 ohms ±5%, 1/2w	DCS-24-001
R24	Res., film, 180 ohms ±10%, 2w	DCR-18-012
T1	Transformer	ABA-F10

*This part only used on units with "M" meter option.

MODELS LM-F12 — LM-F48

COMMON PARTS

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
C1	Cap., mylar, 0.033 mfd ±10%, 400 vdc	CGL33-009
C2	Cap., mylar, 0.22 mfd ±10%, 80 vdc	CGM22-004
C4	Cap., elect., 3.0 mfd -10% +75%, 100 vdc	CBN30-015
C5	Cap., mylar, 0.018 mfd ±10%, 200 vdc	CGL18-005
C6	Same as C5	
C7**	Cap., elect., 140 mfd -10% +100%, 38 vdc	CBR14-030
C8 Thru C10	Not used	
C12 Thru C14	Not used	
C15	Cap., elect., 3,600 mfd -10% +100%, 20 vdc	CBS36-044
C16	Cap., mylar, 0.068 mfd ±10%, 200 vdc	CGL68-003
C17	Same as C16	
C21 thru C24	Not used	
C25	Same as C2	
C30	Cap., mylar, 0.022 mfd ±10%, 200 vdc	CGL22-001
C31	Same as C4	
C38*	Cap., mylar, 0.033 mf ±10%, 400 vdc	CGL-33-009
CR1**	Rectifier, zener diode	FBM-Z104
CR2	Rectifier	FBL00-030
CR3	Same as CR2	
CR4	Not used	
CR5	Not used	
CR6	Rectifier, zener diode	FBM-Z103
CR7	Same as CR2	
CR12 Thru CR15	Not used	
CR16	Rectifier	FBL00-047
CR17	Same as CR16	
DS1+	Lamp assembly	HRD00-003
DS1	Lamp assembly	HRD00-021
F1	Fuse, 20A	FFP-20-000
Q1	Transistor, NPN	FBN-L110
Q2	Same as Q1	
Q3	Same as Q1	
Q4	Not used	
Q5	Transistor, NPN	FBN-L113
Q6	Transistor, NPN	FBN36485
Q7	Same as Q1	
Q8	Not used	
Q9	Not used	
R3	Res., ww, 1,200 ohms ±3%, 2w	DFS12-030
R4**	Res., film, 15,000 ohms ±2%, 1/2w	DCT15-013
R5	Res., film, 220 ohms ±2%, 1/2w	DCR22-005
R6	Res., comp., 180,000 ohms ±10%, 1/2w	DEB1841
R7	Res., film, 3,900 ohms ±5%, 1/2w	DCS39-014
R8	Res., comp., 4,700 ohms ±10%, 1/2w	DEB4721
R9	Res., comp., 150 ohms ±10%, 1/4w	DCB1511
R10	Res., comp., 2,200 ohms ±10%, 1/2w	DEB2221
R11	Res., comp., 22,000 ohms ±10%, 1/2w	DEB2231

COMMON PARTS (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
R12	Res., comp., 470 ohms ±10%, 1/2w	DEB4701
R13**	Res., ww, 600 ohms ±3%, 3w	DFR60-005
R14	Not used	
R15	Not used	
R16++	Res., comp., 560 ohms ±10%, 1/2w	DEB5611
R17	Res., var., ww, 1,200 ohms ±10%, 1-1/2w	DNS12-026
R19 Thru R21	Not used	
R22	Res., comp., 150 ohms ±10%, 1/2w	DEB1511
R23	Res., comp., 15 ohms ±10%, 1/2w	DEB1501
R30 Thru R37	Not used	
R38	Res., comp., 330 ohms ±10%, 1/2w	DEB3311
R39	Res., ww, 0.17 ohm ±5%, 3w	DFM17-052
R42	Res., comp., 33 ohms ±10%, 1/2w	DEB3301
S1	Thermostat	FKA137-014
S2	Switch, SPST, breaker type, no coil (not used on units with "OV" option)	FHC00-003-0
XF1	Fuseholder	HRM-00-013

*C38 not used on units with serial no. prefixes A-D.
**This part not used on units with "Y" option
+This part only used on units with serial no. prefix A
++This part differs on model LM-F28; see LM-F28 parts list

UNIQUE PARTS

MODEL LM-F12

C3	Cap., elect., 14,000 mfd -10% +100%, 35 vdc	CBT-14-012
C11	Cap., paper, 1.0 mfd ±20%, 200 vdc	CAN-10-024
C18 Thru C20	Same as C3	
C26 Thru C29	Same as C11	
CR8	Rectifier	FBL-00-122
CR9 Thru CR11	Same as CR8	
M1*	Meter, volts, DC, 0-15 vdc full scale	EBP-15-017
M2*	Meter, amperes, DC, 0-50 ampere movement	EDP-50-017
Q10	Transistor, NPN	FBN-36972
Q11 Thru Q18	Same as Q10	
R1	Res., var., 2,200 ohms ±5%, 5w	DNS-22-053

MODEL LM-F12 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
R2	Res., ww, 1,800 ohms ±3%, 3w	DFS-18-048
R18	Res., film, 2,400 ohms ±5%, 1/2w	DCS-24-001
R24	Res., film, 180 ohms ±10%, 2w	DCR-18-012
R25 A,B	Res., tapped, two sections, 0.30 ohms ±5%/section 11w/section	DFM-60-050
R26 A,B Thru R29 A,B	Same as R25A,B	
R40	Res., comp., 1,000 ohms ±10%, 2w	DHB-1021
R41*	Res., meter shunt, 50 amperes	ESP-50-002
T1	Transformer	ABA-F12

*This part only used on units with "M" meter option.

MODEL LM-F15

C3	Cap., elect., 14,000 mfd -10% +100%, 35 vdc	CBT-14-012
C11	Cap., paper, 1.0 mfd ±20%, 200 vdc	CAN-10-024
C18 Thru C20	Same as C3	
C26 Thru C29	Same as C11	
CR8	Rectifier	FBL-00-122
CR9 Thru CR11	Same as CR8	
M1*	Meter, volts, DC, 0-20 vdc full scale	EBP-20-014
M2*	Meter, amperes, DC, 0-30 ampere movement	EDP-30-016
Q10	Transistor, NPN	FBN-36220
Q11 Thru Q18	Same as Q10	
R1	Res., var., 2,200 ohms ±5%, 5w	DNS-22-053
R2	Res., ww, 1,800 ohms ±3%, 3w	DFS-18-048
R18	Res., film, 2,400 ohms ±5%, 1/2w	DCS-24-001
R24	Res., film, 470 ohms ±10%, 2w	DCR-47-013
R25 A,B	Res., tapped, two section, 0.47 ohms ±5%/section 8w/section	DFM-94-051
R26 A,B Thru R29 A,B	Same as R25A,B	
R40	Res., comp., 1,000 ohms ±10%, 2w	DHB-1021
R41*	Res., meter shunt, 30 amperes	ESP-30-001
T1	Transformer	ABA-F15

*This part only used on units with "M" meter option.

UNIQUE PARTS (Cont)

MODEL LM-F18

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
C3	Cap., elect., 14,000 mfd -10% +100%, 35 vdc	CBT-14-012
C11	Cap., paper, 1.0 mfd ±20%, 200 vdc	CAN-10-024
C18 Thru C20	Same as C3	
C26 Thru C29	Same as C11	
CR8	Rectifier	FBL-00-122
CR9 Thru CR11	Same as CR8	
M1*	Meter, volts, DC, 0-20 vdc full scale	EBP-20-014
M2*	Meter, amperes, DC, 0-30 ampere movement	EDP-30-016
Q10	Transistor, NPN	FBN-36220
Q11 Thru Q18	Same as Q10	
R1	Res., var., 2,200 ohms ±5%, 5w	DNS-22-053
R2	Res., ww, 2,500 ohms ±3%, 3w	DFS-25-036
R18	Res., film, 6,800 ohms ±5%, 1/2w	DCS-68-021
R24	Res., film, 470 ohms ±10%, 2w	DCR-47-013
R25 A,B	Res., tapped, two sections, 0.47 ohms ±5%/section 8w/section	DFM-94-051
R26 A,B Thru R29 A,B	Same as R25A,B	
R40	Res., comp., 1,000 ohms ±10%, 2w	DHB-1021
R41*	Res., meter shunt, 30 amperes	ESP-30-001
T1	Transformer	ABA-F18

*This part only used on units with "M" meter option

MODEL LM-F20

C3	Cap., elect., 14,000 mfd -10% +100%, 35 vdc	CBT-14-012
C11	Cap., paper, 1.0 mfd ±20%, 200 vdc	CAN-10-024
C18 Thru C20	Same as C3	
C26 Thru C29	Same as C11	
CR8	Rectifier	FBL-00-083
CR9 Thru CR11	Same as CR8	
M1*	Meter, volts, DC, 0-25 vdc full scale	EBP-25-018
M2*	Meter, amperes, DC, 0-30 ampere movement	EDP-30-016
Q10	Transistor, NPN	FBN-36220
Q11 Thru Q18	Same as Q10	
R1	Res., var., 2,200 ohms ±5%, 5w	DNS-22-053

UNIQUE PARTS (Cont)

MODEL LM-F20 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
R2	Res., ww, 2,500 ohms ±3%, 3w	DFS-25-036
R18	Res., film, 6,800 ohms ±5%, 1/2w	DCS-68-021
R24	Res., film, 470 ohms ±10%, 2w	DCR-47-013
R25 A,B	Res., tapped, two sections, 0.47 ohms ±5%/section 8w/section	DFM-94-051
R26 A,B Thru R29 A,B	Same as R25A,B	
R40	Res., comp., 1,000 ohms ±10%, 2w	DHB-1021
R41*	Res., meter shunt, 30 amperes	ESP-30-001
T1	Transformer	ABA-F20

*This part only used on units with "M" meter option

MODEL LM-F24

C3	Cap., elect., 7,800 mfd -10% +100%, 60 vdc	CBS-78-045
C11	Cap., paper, 1.0 mfd ±20%, 200 vdc	CAN-10-024
C18 Thru C20	Same as C3	
C26 Thru C29	Same as C11	
CR8	Rectifier	FBL-00-083
CR9 Thru CR11	Same as CR8	
M1*	Meter, volts, DC, 0-40 vdc full scale	EBP-40-013
M2*	Meter, amperes, DC, 0-20 ampere movement	EDP-20-019
Q10	Transistor, NPN	FBN-36220
Q11 Thru Q18	Same as Q10	
R1	Res., var., 2,200 ohms ±5%, 5w	DNS-22-023
R2	Res., ww, 3,600 ohms ±3%, 3w	DFS-36-050
R18	Res., film, 6,800 ohms ±5%, 1/2w	DCS-68-021
R24	Res., film, 1,000 ohms ±10%, 2w	DCS-10-029
R25 A,B	Res., tapped, two sections, 0.75 ohms ±5%/section 8w/section	DFN-15-056
R26 A,B Thru R29 A,B	Same as R25A,B	
R40	Res., comp., 5,600 ohms ±10%, 2w	DHB-5621
R41*	Res., meter shunt, 20 amperes	ESP-20-004
T1	Transformer	ABA-F24

*This part only used on units with "M" meter option

UNIQUE PARTS (Cont)

MODEL LM-F28

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
C3	Cap., elect., 7,800 mfd -10% +100%, 60 vdc	CBS-78-045
C11	Cap., paper, 1.0 mfd ±20%, 200 vdc	CAN-10-024
C18 Thru C20	Same as C3	
C26 Thru C29	Same as C11	
CR8	Rectifier	FBL-00-083
CR9 Thru CR11	Same as CR8	
M1*	Meter, volts, DC, 0-40 vdc full scale	EBP-40-013
M2*	Meter, amperes, DC, 0-20 ampere movement	EDP-20-019
Q10	Transistor, NPN	FBN-36220
Q11 Thru Q18	Same as Q10	
R1	Res., var., 2,200 ohms ±5%, 5w	DNS-22-053
R2	Res., ww, 4,500 ohms ±3%, 3w	DFS-45-044
R16	Res., film, 240 ohms ±2%, 1/2w	DCR-24-007
R18	Res., film, 6,800 ohms ±5%, 1/2w	DCS-68-021
R24	Res., film, 1,000 ohms ±10%, 2w	DCS-10-029
R25 A,B	Res., tapped, two sections, 0.75 ohms ±5%/section 8w/section	DFN-15-056
R26 A,B Thru R29 A,B	Same as R25A,B	
R40	Res., comp., 5,600 ohms ±10%, 2w	DHB-5621
R41*	Res., meter shunt, 20 amperes	ESP-20-004
T1	Transformer	ABA-F28

*This part only used on units with "M" meter option

MODEL LM-F36

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
C3	Cap., elect., 7,800 mfd -10% +100%, 60 vdc	CBS-78-045
C11	Cap., paper, 0.15 mfd ±20%, 400 vdc	CAM-15-015
C18 Thru C20	Same as C3	
C26 Thru C29	Same as C11	
CR8	Rectifier	FBL-00-083
CR9 Thru CR11	Same as CR8	
M1*	Meter, volts, DC, 0-40 vdc full scale	EBP-40-013
M2*	Meter, amperes, DC, 0-15 ampere movement	EDP-15-014
Q10	Transistor, NPN	FBN-36487

UNIQUE PARTS (Cont)

MODEL LM-F36 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
Q11 Thru Q18	Same as Q10	
R1	Res., var., 3,300 ohms ±5%, 5w	DNS-33-054
R2	Res., ww, 5,600 ohms ±3%, 3w	DFS-56-053
R18	Res., film, 10,000 ohms ±5%, 1/2w	DCT-10-008
R24	Res., film, 1,000 ohms ±10%, 2w	DCS-10-029
R25 A,B,	Res., tapped, two sections, 0.75 ohms ±5%/section 8w/section	DFN-15-056
R26 A,B Thru R29 A,B	Same as R25A,B	
R40	Res., comp., 5,600 ohms ±10%, 2w	DHB-5621
R41	Not used	
T1	Transformer	ABA-F36

*This part only used on units with "M" meter option

MODEL LM-F48

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
C3	Cap., elect., 3,000 mfd -10% +100%, 100 vdc	CBS-30-047
C11	Cap., paper, 0.15 mfd ±20%, 400 vdc	CAM-15-015
C18 Thru C20	Same as C3	
C26 Thru C29	Same as C11	
CR8	Rectifier	FBL-00-083
CR9 Thru CR11	Same as CR8	
M1*	Meter, volts, DC, 0-60 vdc full scale	EBP-60-015
M2*	Meter, amperes, DC, 0-10 ampere movement	EDP-10-013
Q10	Transistor, NPN	FBN-36487
Q11 Thru Q18	Same as Q10	
R1	Res., var., 3,300 ohms ±5%, 5w	DNS-33-054
R2	Res., ww, 8.000 ohms ±3%, 3w	DFS-80-054
R18	Res., film, 10,000 ohms ±5%, 1/2w	DCT-10-008
R24	Res., film, 1,500 ohms ±10%, 2w	DCS-15-030
R25 A,B,	Res., tapped, two sections, 1.5 ohms ±5%/section 8w/section	DFN-30-057
R26 A,B Thru R29 A,B	Same as R25A,B	
R40	Res., comp., 5,600 ohms ±10%, 2w	DHB-5621
R41	Not used	
T1	Transformer	ABA-F48

*This part only used on units with "M" meter option

COMMON PARTS

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
C1	Cap., mylar, 0.033 mfd ±10%, 400 vdc	CGL-33-009
C2	Cap., mylar, 0.15 mfd ±10%, 200 vdc	CGM-15-005
C3	Cap., elect., 250 mfd -10 +100%, 250 vdc	CBR-25-046
C4	Cap., elect., 3.5 mfd -10 +100%, 300 vdc	CBN-35-018
C5	Cap., mylar, 0.0068 mfd ±10%, 200 vdc	CGK-68-001
C6	Cap., mylar, 0.01 mfd ±10%, 80 vdc	CGM-10-006
C7*	Cap., elect., 140 mfd -10 +100%, 38 vdc	CBR-14-030
C8 Thru C12	Not assigned	
C13, C14	Cap., mylar, 0.01 mfd ±10%, 200 vdc	CGL-10-002
C15 Thru C17	Not assigned	
C18, C19	Cap., elect., 1,200 mfd -10 +100%, 250 vdc	CBS-12-048
C20 Thru C25	Not assigned	
C26	Cap., paper, 0.15 mfd ±20%, 400 vdc	CAM-15-015
C27 Thru C29	Same as C26	
C30	Cap., mylar, 0.022 mfd ±10%, 200 vdc	CGL-22-001
C31	Cap., elect., 5.6 mfd -10 +100%, 250 vdc	CBN-56-026
C38**	Cap., mylar, 0.033 mf ±10%, 400 vdc	CGL-33-009
DS1	Lamp assembly	HRD-00-021
CR1*	Rectifier, zener diode	FBM-Z104
CR2	Rectifier	FBL-00-030
CR3	Same as CR2	
CR4, CR5	Not assigned	
CR6	Rectifier, zener diode	FBM-Z103
CR7	Same as CR2	
CR8	Rectifier	FBL-00-052
CR9 Thru CR11	Same as CR8	
CR12 Thru CR17	Not assigned	
CR18	Rectifier	FBL-00-064
CR19	Same as CR1	
F1	Fuse, 20A	FFP-20-000
M2+	Meter, amperes, D.C., 0-5 amperes	EDN-50-021
Q1	Transistor, NPN	FBN-L110
Q2	Same as Q1	
Q3	Same as Q1	
Q4	Not assigned	
Q5	Transistor, NPN	FBN-L108
Q6	Transistor, NPN	FBN-35903
Q7	Not assigned	
Q8	Same as Q5	
Q9	Same asQ6	

MODELS LM-F100 — LM-F150 (Cont)

COMMON PARTS (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
Q10 Thru Q13	Transistor, NPN	FBN-35902
Q14	Not assigned	
Q15 Thru Q18	Same as Q10	
R1	Res., var., ww, 9,000 ohms ±5%, 5w	DNS-90-051
R3	Res., ww, 1,200 ohms ±3%, 2w	DFS-12-030
R4*	Res., film, 15,000 ohms ±2%, 1/2w	DCT-15-013
R5	Res., film, 220 ohms ±2%, 1/2w	DCR-22-005
R6	Res., comp., 180,000 ohms ±10%, 1/2w	DEB-1841
R7	Res., film, 3,900 ohms ±5%, 1/2w	DCS-39-014
R8	Res., comp., 4,700 ohms ±10%, 1/2w	DEB-4721
R9	Res., comp., 150 ohms ±10%, 1/4w	DCB-1511
R10	Res., comp., 3,900 ohms ±10%, 1/2w	DEB-3921
R11	Res., comp., 22,000 ohms ±10%, 1/2w	DEB-2231
R12	Res., comp., 47 ohms ±10%, 1/2w	DEB-4701
R13*	Res., ww, 600 ohms ±3%, 3w	DFR-60-005
R14, R15	Not assigned	
R16	Res., comp., 560 ohms ±10%, 1/2w	DEB-5611
R17	Res., var., ww, 1,200 ohms ±10%, 1-1/2w	DNS-12-026
R19 Thru R21	Not assigned	
R22	Res., comp., 220 ohms ±10%, 1/2w	DEB-2211
R23	Res., comp., 22 ohms ±10%, 1/2w	DEB-2201
R24	Res., film, 12,000 ohms ±10%, 2w	DCT-12-022
R25A Thru R26B	Res., ww, two sections, 1.5 ohms ±5%, 8w/section	DFN-30-057
R27	Same as R22	
R27A,B	Not assigned	
R28A Thru R29B	Same as R25A	
R30 Thru R35	Not assigned	
R36, R37	Res., ww, 8.000 ohms ±3%, 3w	DFS-80-054
R38	Same as R23	
R39	Res., comp., 2,200 ohms ±10%, 1/2w	DEB-2221
S1	Thermostat	FKA-118-012
S2	Switch, SPST, breaker type, no coil (not used on models with OV option)	FHC-00-003-0
XF1	Fuseholder	HRM-00-009

+This part only used on models with "M" meter suffix
*This part not used on models with "Y" option
**C38 not used on units with serial no. prefixes A-D.

UNIQUE PARTS

MODEL LM-F100

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
M1*	Meter, volts, D.C., 0-120 vdc	EBR-12-075
R2	Res., ww, 16,000 ohms ±3%, 5w	DFT-16-039
R18	Res., film, 39,000 ohms ±5%, 1/2w	DCT-39-015
T1	Transformer	ABA-F100

*This part only used on units with "M" meter option

MODEL LM-F120

M1*	Meter, volts, D.C., 0-150 vdc	EBR-15-076
R2	Res., ww, 20,000 ohms ±3%, 5w	DFT-20-040
R18	Res., film, 43,000 ohms ±5%, 1/2w	DCT-43-016
T1	Transformer	ABA-F120

*This part only used on units with "M" meter option

MODEL LM-F150

M1*	Meter, volts, D.C., 0-200 vdc	EBR-20-077
R2	Res., ww, 26,000 ohms ±3%, 5w	DFT-26-041
R18	Res., film, 56,000 ohms ±5%, 1w	DCT-56-017
T1	Transformer	ABA-F150

*This part only used on units with "M" meter option

PARTS FOR MODEL LM-F60

C1	Cap., mylar, 0.033 mfd ±10%, 400 vdc	CGL-33-009
C2	Cap., mylar, 0.22 mfd ±10%, 80 vdc	CGM-22-004
C3	Cap., elect., 1,200 mfd -10 +100%, 250 vdc	CBS-12-048
C4	Cap., elect., 3.5 mfd -10 +100%, 300 vdc	CBN-35-018
C5, C6	Cap., mylar, 0.018 mfd ±10%, 200 vdc	CGL-18-005
C7*	Cap., elect., 140 mfd -10 +100%, 38 vdc	CBR-14-030
C8 Thru C17	Not assigned	
C18, C19	Same as C3	
C20 Thru C25	Not assigned	
C26	Cap., paper, 0.15 mfd ±20%, 400 vdc	CAM-15-015
C27 Thru C29	Same as C26	
C30	Cap., mylar, 0.022 mfd ±10%, 200 vdc	CGL-22-001
C31	Cap., elect., 3.5 mfd -10 +100%, 300 vdc	CBN-35-018
C38**	Cap., mylar, 0.033 mf ±10%, 400 vdc	CGL-33-009
CR1*	Rectifier, zener diode	FBM-Z104
CR2, CR3	Rectifier	FBL-00-030
CR4, CR5	Not assigned	

PARTS FOR MODEL LM-F60 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
CR6	Rectifier, zener diode	FBM-Z103
CR7	Same as CR2	
CR8	Rectifier	FBL-00-054
CR9 Thru CR11	Same as CR8	
DS1	Lamp assembly	HRD-00-021
F1	Fuse, 20A	FFP-20-000
M1+	Meter, volts, D.C., 0-80 vdc	EBP-80-019
M2+	Meter, amperes, D.C., 0-10 amperes	EDP-10-013
Q1	Transistor, NPN	FBN-L110
Q2	Same as Q1	
Q3	Same as Q1	
Q4	Not assigned	
Q5	Transistor, NPN	FBN-L108
Q6	Transistor, NPN	FBN-35902
Q7 Thru Q9	Not assigned	
Q10	Same as Q6	
Q11 Thru Q18	Same as Q6	
R1	Res., var., ww, 4,500 ohms ±5%, 5w	DNS-45-059
R2	Res., ww, 10,000 ohms ±3%, 5w	DFT-10-042
R3	Res., ww, 1,200 ohms ±3%, 2w	DFS-12-030
R4*	Res., film, 15,000 ohms ±2%, 1/2w	DCT-15-013
R5	Res., film, 220 ohms ±2%, 1/2w	DCR-22-005
R6	Res., comp., 180,000 ohms ±10%, 1/2w	DEB-1841
R7	Res., film, 3,900 ohms ±5%, 1/2w	DCS-39-014
R8	Res., comp., 4,700 ohms ±10%, 1/2w	DEB-4721
R9	Res., comp., 150 ohms ±10%, 1/4w	DCB-1511
R10	Res., comp., 3,900 ohms ±10%, 1/2w	DEB-3921
R11	Res., comp., 22,000 ohms ±10%, 1/2w	DEB-2231
R12	Res., comp., 47 ohms ±10%, 1/2w	DEB-4701
R13*	Res., ww, 600 ohms ±3%, 3w	DFR-60-005
R14, R15	Not assigned	
R16	Res., comp., 560 ohms ±10%, 1/2w	DEB-5611
R17	Res., var., ww, 1,200 ohms ±10%, 1-1/2w	DNS-12-026
R18	Res., film, 15,000 ohms ±2%, 1/2w	DCT-15-013
R19 Thru R21	Not assigned	
R22	Res., comp., 220 ohms ±10%, 1/2w	DEB-2211
R23	Res., comp., 22 ohms ±10%, 1/2w	DEB-2201
R24	Res., film, 5,600 ohms ±10%, 2w	DCS-56-033
R25A Thru R29B	Res., ww, tapped two sections, 1.5 ohms ±5%, 8w/section	DFN-30-057

PARTS FOR MODEL LM-F60 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
R30 Thru R39	Not assigned	
R40	Res., comp., 10,000 ohms ±10%, 2w	DHB-1031
S1	Thermostat	FKA-137-014
S2	Switch, SPST, breaker type, no coil (not used on units with "OV" option)	FHC-00-003-0
T1	Transformer	ABA-F60
XF1	Fuseholder	HRM-00-009

*This part not used on units with "Y" option
+This part only used on units with "M" meter option
**C38 not used on units with serial number prefixes A-D.

PARTS FOR MODEL LMF-0-7

C1	Cap., mylar, 0.033 mfd ±10%, 400 vdc	CGL-33-009
C2	Cap., mylar, 0.22 mfd ±10%, 80 vdc	CGM-22-004
C3	Cap., elect., 25,000 mfd -10 +100%, 20 vdc	CBT-25-011
C4	Cap., elect., 3.0 mfd -10 +75%, 100 vdc	CBN-30-015
C5, C6	Cap., mylar, 0.018 mfd ±10%, 20 vdc	CGL-18-005
C7*	Cap., elect., 140 mfd -10 + 100%, 38 vdc	CBR-14-030
C8	Not assigned	
C9, C10	Cap., paper, 1.0 mfd ±20%, 200 vdc	CAN-10-024
C11 Thru C14	Not assigned	
C15	Cap., elect., 3,600 mfd -10 +100%, 20 vdc	CBS-36-044
C16, C17	Cap., mylar, 0.06 mfd ±10%, 200 vdc	CGL-68-003
C18 Thru C20	Same as C3	
C21 Thru C24	Not assigned	
C25	Same as C2	
C26 Thru C29	Not assigned	
C30	Cap., mylar, 0.022 mfd ±10%, 200 vdc	CGL-22-001
C31	Cap., elect., 3.0 mfd -10 +75%, 100 vdc	CBN-30-015
C38**	Cap., mylar, 0.033 mf ±10%, 400 vdc	CGL-33-009
CR1*	Rectifier, zener diode	FBM-Z104
CR2	Rectifier	FBL-00-030
CR3 Thru CR5	Not assigned	
CR6	Rectifier, zener diode	FBM-Z103
CR7	Same as CR2	
CR8	Rectifier	FBL-00-122
CR9	Not assigned	
CR10	Same as CR8	
CR11	Not assigned	
CR12	Same as CR8	
CR13 Thru CR15	Not assigned	

PARTS FOR MODEL LMF-0-7 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
CR16, CR17	Rectifier	FBL-00-047
CR18, CR19	Same as CR2	
DS1	Lamp assembly	HRD-00-021
F1	Fuse, 10A	FEP-10-000
M1-	Meter, volts, D.C., 0-8 vdc	EBN-80-005
M2+	Meter, amperes, D.C., 0-30 amperes	EDP-30-016
Q1	Transistor, NPN	FBN-L110
Q2	Same as Q1	
Q3	Same as Q1	
Q4	Not assigned	
Q5	Transistor, NPN	FBN-L113
Q6	Transistor, NPN	FBN-36485
Q7	Transistor, NPN	FBN-L125
Q8, Q9	Not assigned	
Q10 Thru Q18	Same as Q6	
Q19 Thru Q27	Not assigned	
Q28	Transistor, NPN	FBN-L155
R1	Res., var., ww, 2,200 ohms ±5%, 5w	DNS-22-053
R2	Not assigned	
R3	Res., ww, 1,100 ohms ±3%, 2w	DFS-11-061
R4*	Res., film, 15,000 ohms ±2%, 1/2w	DCT-15-013
R5	Res., film, 220 ohms ±2%, 1/2w	DCR-22-005
R6	Res., comp., 180,000 ohms ±10%, 1/2w	DEB-1841
R7	Res., film, 3,900 ohms ±5%, 1/2w	DCS-39-014
R8	Res., comp., 4,700 ohms ±10%, 1/2w	DEB-4721
R9	Res., comp., 150 ohms ±10%, 1/4w	DCB-1511
R10	Res., comp., 2,200 ohms ±10%, 1/2w	DEB-2221
R11	Res., comp., 22,000 ohms ±10%, 1/2w	DEB-2231
R12	Not assigned	
R13*	Res., ww, 600 ohms ±3%, 3w	DFR-60-005
R14, R15	Not assigned	
R16	Res., comp., 560 ohms ±10%, 1/2w	DEB-5611
R17	Res., var., ww, 1,200 ohms ±10%, 1-1/2w	DNS-12-026
R18 Thru R21	Not assigned	
R22	Res., comp., 150 ohms ±10%, 1/2w	DEB-1511
R23	Res., comp., 15 ohms ±10%, 1/2w	DEB-1501
R24	Not assigned	
R25A,B	Res., ww, two sections, 0.47 ohms ±5%, 8w/section	DFM-94-051
R26A,B Thru R27A	Same as R25A	

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
R27B	Not assigned	
R28A, B thru R29A, B	Same as R25A	
R30 thru R37	Not assigned	
R38	Res., comp., 330 ohms ±10%, 1/2w	DEB-3311
R39	Res., ww, 0.17 ohms ±5%, 3w	DFM-17-052
R40	Res., comp., 270 ohms ±10%, 2w	DHB-2711
R41+	Res., meter shunt, 30 amperes	ESP-30-001
R42	Res., comp., 33 ohms ±10%, 1/2w	DEB-3301
R43	Res., comp., 150 ohms ±10%, 1/2w	DEB-1511
R44	Res., comp., 470 ohms ±10%, 2w	DHB-4711
R45	Res., comp., 220 ohms ±10%, 1w	DGB-2211
R46	Res., comp., 12 ohms ±10%, 1/2w	DEB-1201
S1	Thermostat	FKA-137-014
S2	Switch, DPST (not used on models with O.V. option)	FDA-21-018
T1	Transformer	ABA-F07
XF1	Fuseholder	HRM-00-009

*This part not used on units with "Y" option
+This part only used on units with "M" meter option
**C38 not used on units with serial no. prefixes A-D.

PARTS FOR "OV OPTION"

The following parts are used only on LM-F models with the "OV" option

LMOV-1F overvoltage sub-assembly used on models LM-F-0-7, LM-F2 Thru LM-F6 (see separate electrical parts list LMOV-1F for components located on this sub-assembly)	LMOV 1F
LMOV-2F overvoltage sub-assembly used on models LM-F8 thru LM-F15 (See separate electrical parts list LMOV-2F for components located on this sub-assembly)	LMOV-2F
LMOV-3F overvoltage sub-assembly used on models LM-F18 thru LM-60 (see separate electrical parts list LMOV-3F for components located on this sub-assembly)	LMOV-3F

MODELS LM-F2 — LM-F60, LM-F-0-7

C71	Cap., elect., 10 mfd -10% + 100%, 25 vdc	CBP-10-018
CB1	Circuit breaker, magnetic	FHC-01-001-2

MODELS LM-F2 — LM-F60, LM-F-0-7 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
R71	Not used in models LM-F3 thru LM-F10, LMF 0-7	
R71	Res., ww, 2.0 ohms ±3%, 3w (used in models LM-F12 thru LM-F24 only)	DFN-20-009
R71	Res., ww, 5.0 ohms ±5%, 5w (used in models LM-F28 thru LM-F36 only)	DFN-50-025
R71	Res., ww, 10.0 ohms ±3%, 3w (used in models LM-F48 thru LM-F60 only)	DFP-10-030
R72	Res., comp., 3.3 ohms ±10%, 1/2w	DEB-33G1
R73	Res., ww, 1.0 ohms ±3%, 3w	DFN-10-041
SCR 71	Rectifier, silicon, controlled	FBP-00-010

MODELS LMOV-1F, LMOV-2F, LMOV-3F

COMMON PARTS

C1	Cap., mylar, 0.01 mfd ±20%, 80 vdc	CGL-10-008
Q1	Transistor, NPN	FBN-L102
R3	Res., film, 200 ohms ±5%, 1/2w	DCR-20-010
R4	Res., thermistor, 425 ohms, ±5%, 1/4w	DKR-43-004
R5	Res., comp., 1,200 ohms ±10%, 1/2w	DEB-1221
R6	Same as R5	
R8	Res., comp., 15,000 ohms, ±10%, 1/2w	DEB-1531
R10	Same as R5	
SCR1	Rectifier, silicon, controlled	FBP-00-009

UNIQUE PARTS

MODEL LMOV-1F

Q2	Transistor, PNP	FBN-L103
R1	Res., var., ww or cermet, 2,000 ohms, +10%, 3/4w	DNS-20-034
R2	Res., film 560 ohms ±2%, 1/2w	DCR-56-002
R7	Res., comp., 33 ohms ±5%, 1/4w	DCB-3305
R9	Res., comp., 22 ohms ±10%, 1/2w	DEB-2201

MODEL LMOV-2F

Q2	Transistor, PNP	FBN-L103
R1	Res., var., ww or cermet, 5,000 ohms +10%, 3/4w	DNS-50-036
R2	Res., film, 1,470 ohms ±1%, 1/2w	DCS-15-031
R7	Res., comp., 33 ohms ±5%, 1/4w	DCB-3305
R9	Res., comp., 68 ohms ±10%, 1/2w	DEB-6801

MODEL LMOV-3F

Q2	Transistor, PNP	FBN-L114
R1	Res., var., ww or cermet, 20,000 ohms +10%, 3/4w	DNT-20-010
R2	Res., film, 4,700 ohms ±2%, 1/2w	DCS-47-028
R7	Res., comp., 39 ohms ±5%, 1/4w	DCB-3905
R9	Res., comp., 220 ohms ±10%, 1/2w	DEB-2211

PARTS FOR "T" OPTION

ALL "F" PACKAGE MODELS EXCEPT F1 CHANGES ON LMF-0-7; LM-F3 THRU LM-F6

The following parts change and a resistor is added in series to DS-1:

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.
C1	Cap., mylar, 0.033 mfd ±10%, 600 vdc	CGL-33-014
F1	Fuse, "SLO-BLO," 10.0 amps 250V	FFG-10-000
T1	Transformer	ADD SUFFIX "T" TO REG. T1 NO.
DS1 (Res)	Res., comp., 68K ±10%	DEB-6831

On following models F1 has different value

MODELS LM-F3P3 THRU LM-F4P5

F1	Fuse, "SLO-BLO", 7.0 amps 250V	FFG-07-000

MODEL LM-F3

F1	Fuse, "SLO-BLO", 6.25 amps 250V	FFG-06-250

MODEL LMF-0-7

F1	Fuse, "SLO-BLO", 5.0 amps 250V	FFG-05-000

MODELS LM-F5, LM-F6

F1	Fuse, "SLO-BLO", 8.0 amps 250V	FFG-08-000

PARTS FOR "V" OPTION

F package models with the "V" option have the same part changes as listed for the "T" option except for capacitors C1 & C38, fuse F1, and transformer T1 listed below:

ALL MODELS

C1, C38	Cap, paper, 0.01 mfd ±10%, 1000 vdc	CAL-10-021
T1	Transformer	Add suffix "G"* to reg. T1 No.

MODELS LM-F2 thru LM-F4P5, LMF-0-7

F1	Fuse, 7A	FFP-07-000

MODELS LM-F5 thru LM-F150

F1	Fuse, 10A	FFP-10-000

*Suffix "V" on units with serial no. prefixes A-E.

MODEL LM-F2, LM-F3

R1	Res., var., ww, 300 ohms ±5%, 5w	DNR-30-031

MODELS LM-F3P3-LM-F6

R1	Res., var., ww, 600 ohms ±5%, 5w	DNR-60-032

PARTS FOR "R" OPTION

Transformer T1 changes on all "F" package models with suffix "R". For transformer T1 used on these models see standard "F" model parts lists for the standard transformer part no. and add suffix "R" to the part no.

PARTS FOR "Y" OPTION

C107	Cap., elect., 40 mfd, 35 vdc	CBP-40-014
CR1	Rect., zener diode	FBM-Z107
CR101	Rect., zener diode	FBM-Z104
Q101	Transistor NPN	FBN-L-109
R4	Res., comp., 220,000 ohms ± 10%, 1/2w	DEB-2241
R101	Res., film, 6,800 ohms ±2%, 1/4w	DCS-68-032
R102	Res., film, 220 ohms ±2%, 1/4w	DCR-22-014

PARTS FOR "S", "SP" OPTION AUXILIARY "OV" CIRCUIT

Resistor R2 is replaced by a jumper ("S" option only) on fixed voltage LM-F models and the following parts are added to the "O.V." option.

CR201, CR202	Rectifier	FBL-00-030
CR203*	Same as CR201	
Q200	Transistor, NPN	FBN-L113
R204	Res., comp., 1,000 ohms ±5%, 1/2w	DEB-1025
R205 †	Res., ww, 25 ohms ±5%, 3w	DFP-25-023
R205 ††	Res., ww, 10 ohms ±5%, 3w	DFP-10-030
R206	Res., comp., 47,000 ohms ±10%, 1/2w	DEB-4731
R207	Res., comp., 1,000 ohms ±10%, 1/2w	DEB-1021
R208 †	Res., comp., 220 ohms ±5%, 1/2w	DEB-2215
R208 ††	Res., comp., 100 ohms ±5%, 1/2w	DEB-1015
SCR200	Rectifier, silicon controlled	FBP-00-028

*On 3 thru 6 volt and 0-7 volt models CR203 is replaced by a jumper.
† Not used on 3 thru 6 and 0-7 volt models.
†† Only used on 3 thru 6 and 0-7 volt models.

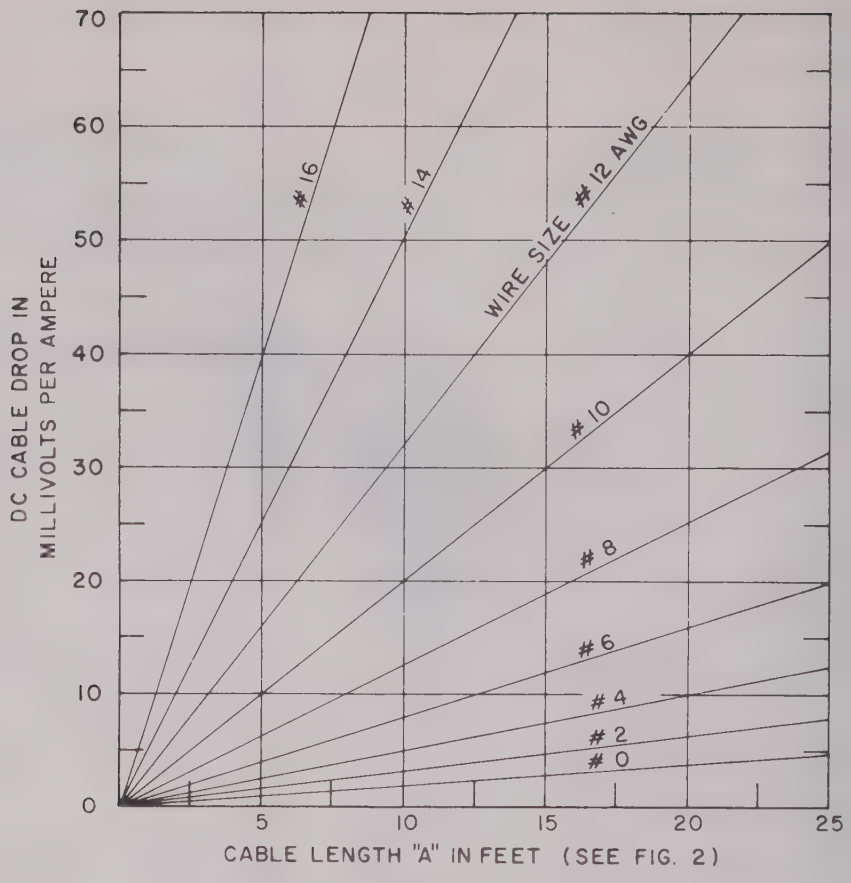


Figure 1. Cable Connection Chart

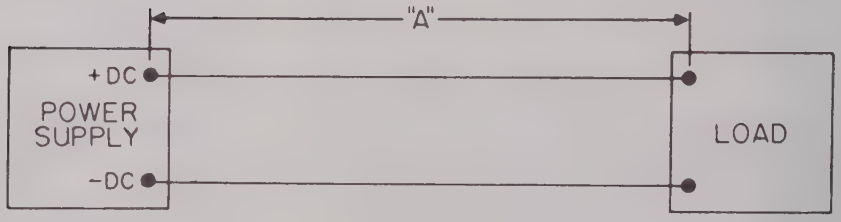
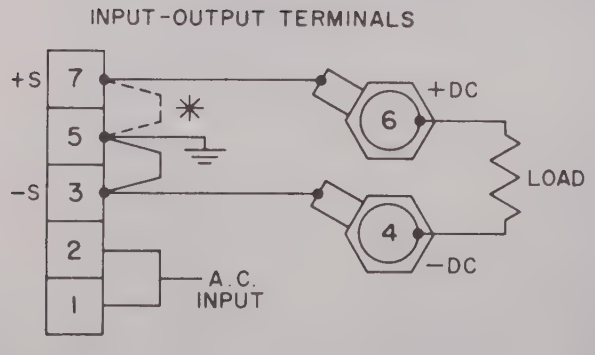


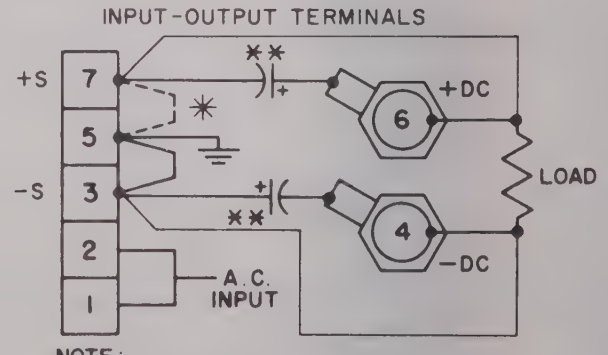
Figure 2. Cable Length "A" in Feet



NOTE:

✳ FOR POSITIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 3 AND 5 AND RECONNECT TO TERMINALS 5 AND 7.

Figure 3. Local Sensing Connections



NOTE:

✳ FOR POSITIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 3 AND 5 AND RECONNECT TO TERMINALS 5 AND 7.

✳✳ A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

Figure 4. Remote Sensing Connections

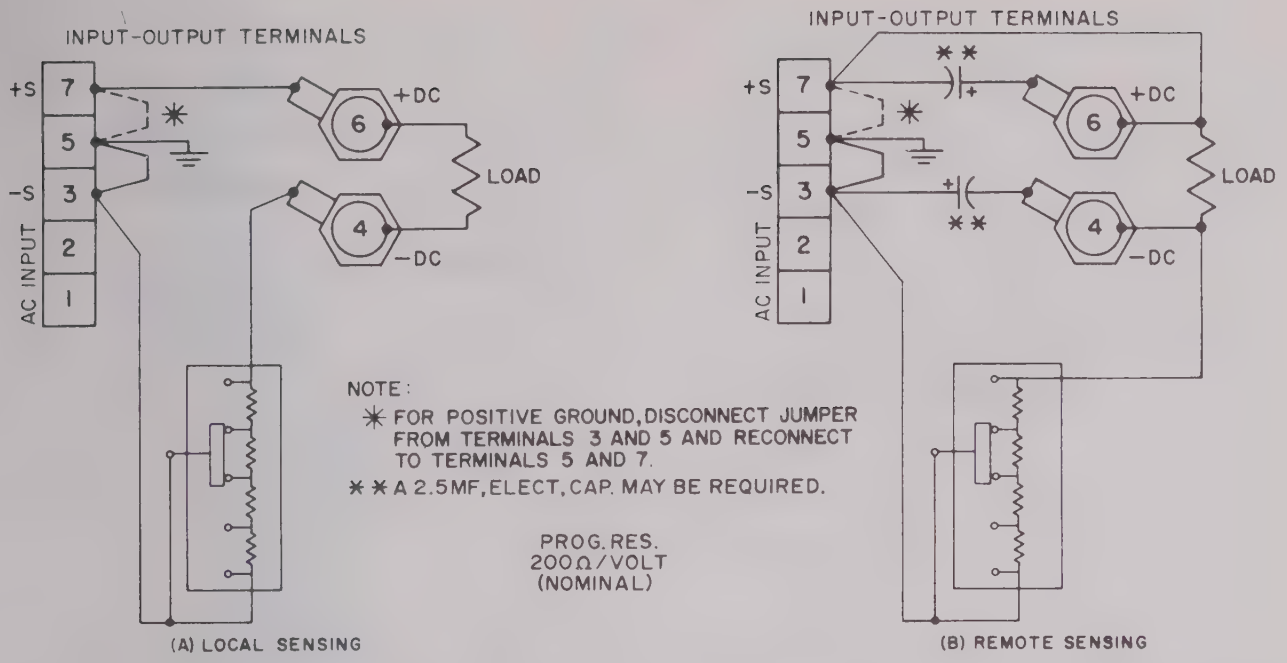


Figure 5. Programmed Voltage With External Resistor

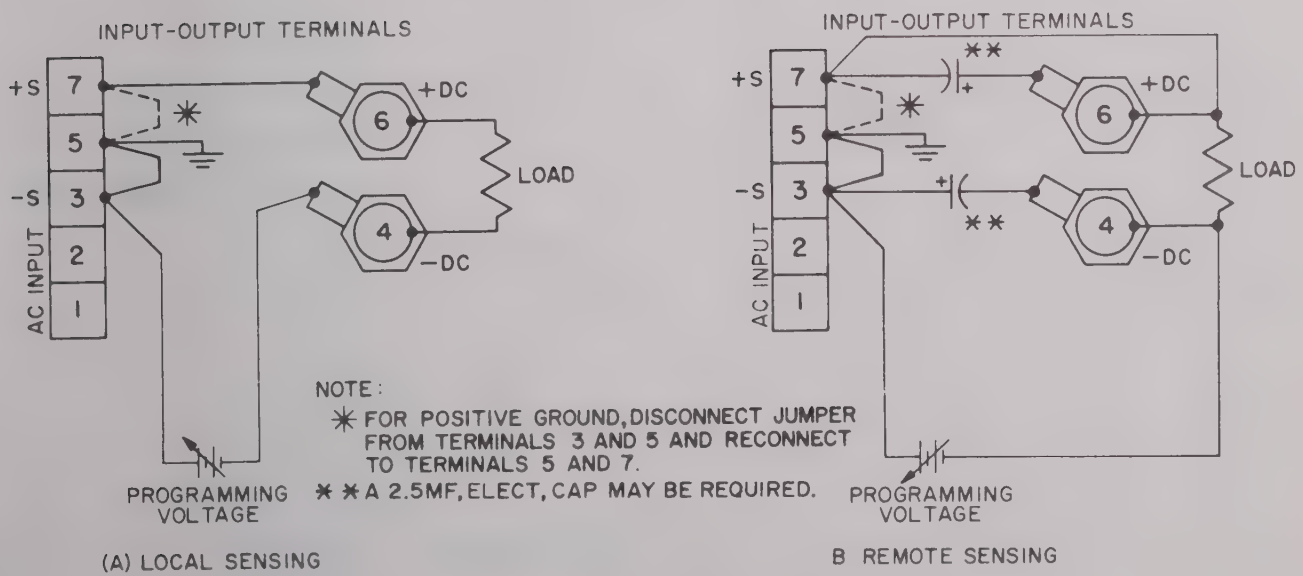


Figure 6. Programmed Voltage With External Programming Voltage Source

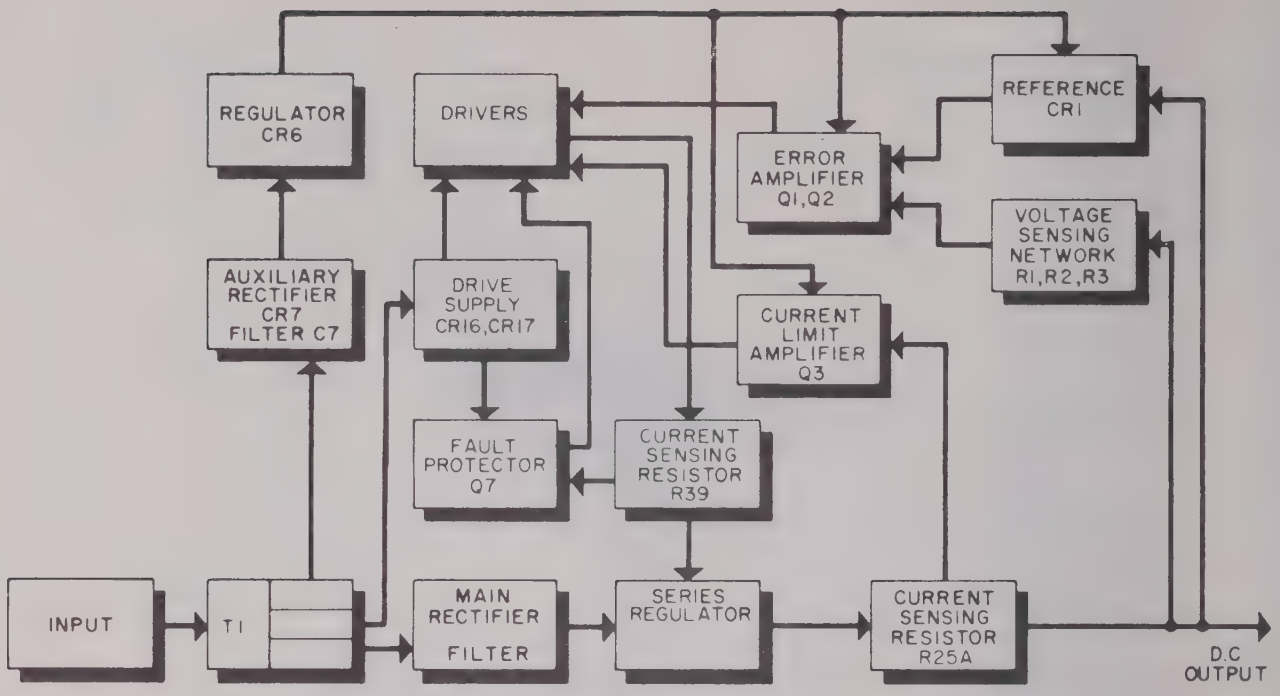
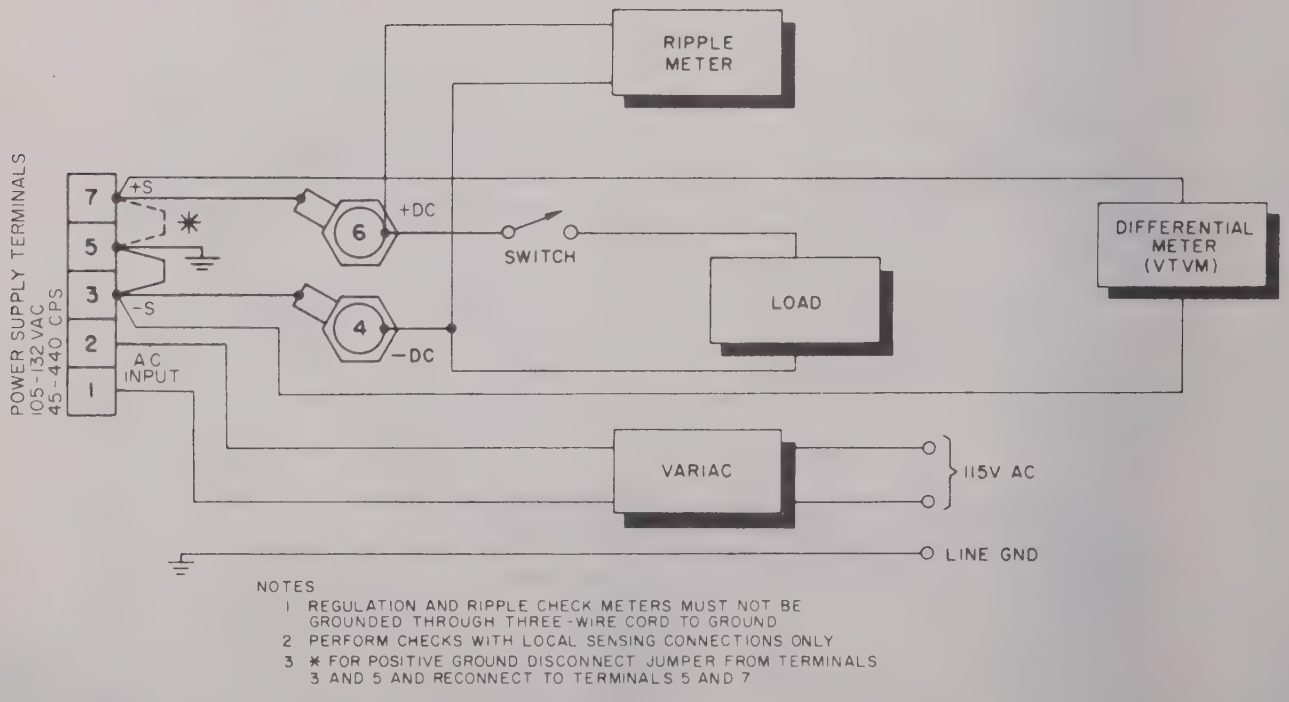


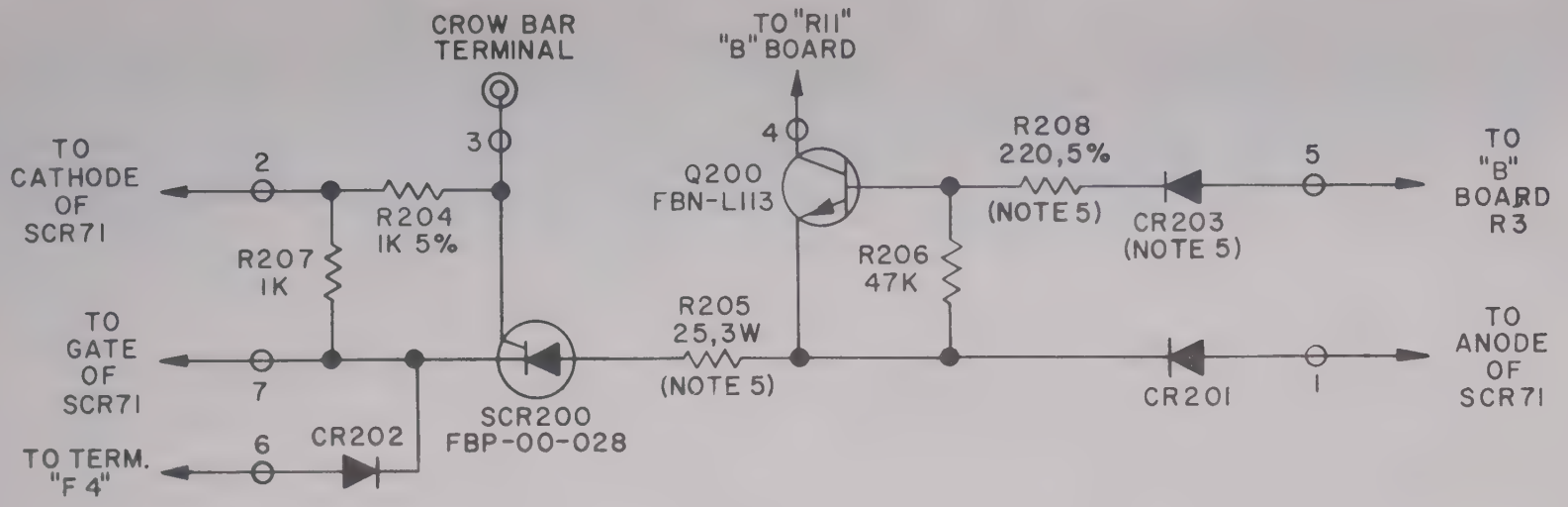
Figure 7. Typical Block Diagram



NOTES

1. REGULATION AND RIPPLE CHECK METERS MUST NOT BE GROUNDED THROUGH THREE-WIRE CORD TO GROUND
2. PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY
3. * FOR POSITIVE GROUND DISCONNECT JUMPER FROM TERMINALS 3 AND 5 AND RECONNECT TO TERMINALS 5 AND 7

Figure 8. Test Connections for Performance Checks



NOTES:

1. RESISTORS ARE 1/2 W, COMPOSITION WITH VALUES IN OHMS, UNLESS OTHERWISE NOTED.
2. SYMBOLS:
   - —▶— INDICATES LAMBDA PT. NO. FBL-00-030.
   - —○— INDICATES TERM. POINT ON WIRING BOARD.
   - ◎ INDICATES TURRET TERMINAL.
3. DESIGNATIONS ARE LAMBDA PT. NOS.
4. THIS SCHEMATIC APPLIES ONLY TO LAMBDA LM-F, LM-G, & LM-H MODELS WITH THE "OV-S" OR "OV-SP" SUFFIX.
5. ON 3 THRU 6 AND 0-7 VOLT MODELS R205 & R208 ARE 10 & 100 OHMS RESPECTIVELY; CR203 IS REPLACED BY A JUMPER.

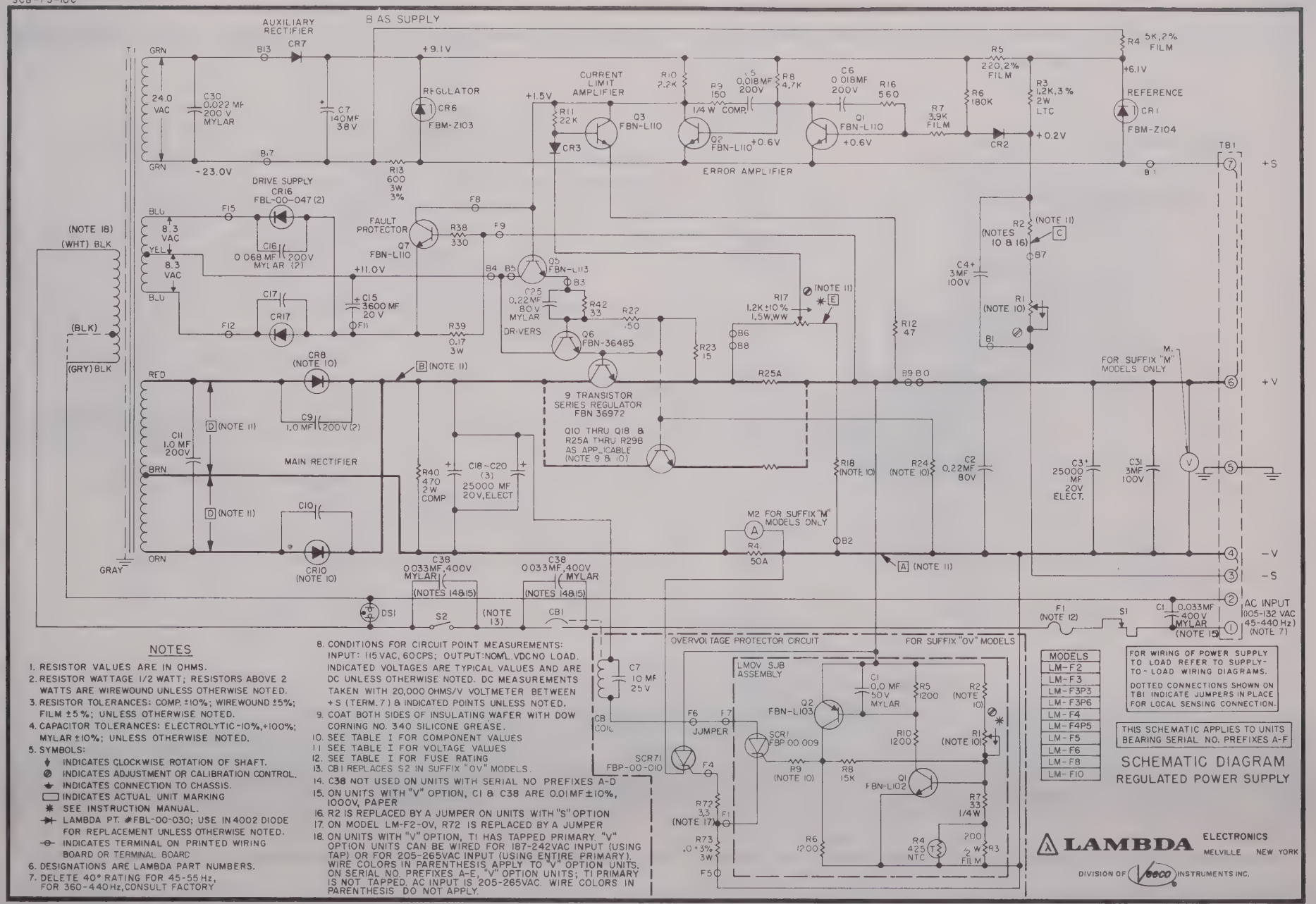
SCHEMATIC DIAGRAM

"S", "SP" OPTION

AUXILIARY "OV" CIRCUIT

LAMBDA
ELECTRONICS
MELVILLE, L.I., NEW YORK
DIVISION OF Veeco INSTRUMENTS INC.

SCB-F3-10C



NOTES

1. RESISTOR VALUES ARE IN OHMS.
2. RESISTOR WATTAGE 1/2 WATT; RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED.
3. RESISTOR TOLERANCES: COMP. ±10%; WIREWOUND ±5%; FILM ±5%; UNLESS OTHERWISE NOTED.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10%,+100%; MYLAR ±10%; UNLESS OTHERWISE NOTED.
5. SYMBOLS:
   - INDICATES CLOCKWISE ROTATION OF SHAFT.
   - INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - INDICATES CONNECTION TO CHASSIS.
   - INDICATES ACTUAL UNIT MARKING
   - SEE INSTRUCTION MANUAL.
   - LAMBDA PT. #FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD
6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
7. DELETE 40° RATING FOR 45-55 Hz, FOR 360-440 Hz, CONSULT FACTORY
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60CPS; OUTPUT: NOM'L. VDC NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM. 7) & INDICATED POINTS UNLESS NOTED.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.
10. SEE TABLE I FOR COMPONENT VALUES
11. SEE TABLE I FOR VOLTAGE VALUES
12. SEE TABLE I FOR FUSE RATING
13. CB1 REPLACES S2 IN SUFFIX "OV" MODELS.
14. C38 NOT USED ON UNITS WITH SERIAL NO PREFIXES A-D
15. ON UNITS WITH "V" OPTION, C1 & C38 ARE 0.01MF ±10%, 1000V, PAPER
16. R2 IS REPLACED BY A JUMPER ON UNITS WITH "S" OPTION
17. ON MODEL LM-F2-OV, R72 IS REPLACED BY A JUMPER
18. ON UNITS WITH "V" OPTION, T1 HAS TAPPED PRIMARY. "V" OPTION UNITS CAN BE WIRED FOR 187-242VAC INPUT (USING TAP) OR FOR 205-265VAC INPUT (USING ENTIRE PRIMARY). WIRE COLORS IN PARENTHESIS APPLY TO "V" OPTION UNITS. ON SERIAL NO. PREFIXES A-E, "V" OPTION UNITS; T1 PRIMARY IS NOT TAPPED. AC INPUT IS 205-265VAC. WIRE COLORS IN PARENTHESIS DO NOT APPLY.

MODELS
LM-F2
LM-F3
LM-F3P3
LM-F3P6
LM-F4
LM-F4P5
LM-F5
LM-F6
LM-F8
LM-F10

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS.

DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIXES A-F

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

LAMBDA ELECTRONICS
MELVILLE NEW YORK
DIVISION OF Veeco INSTRUMENTS INC.

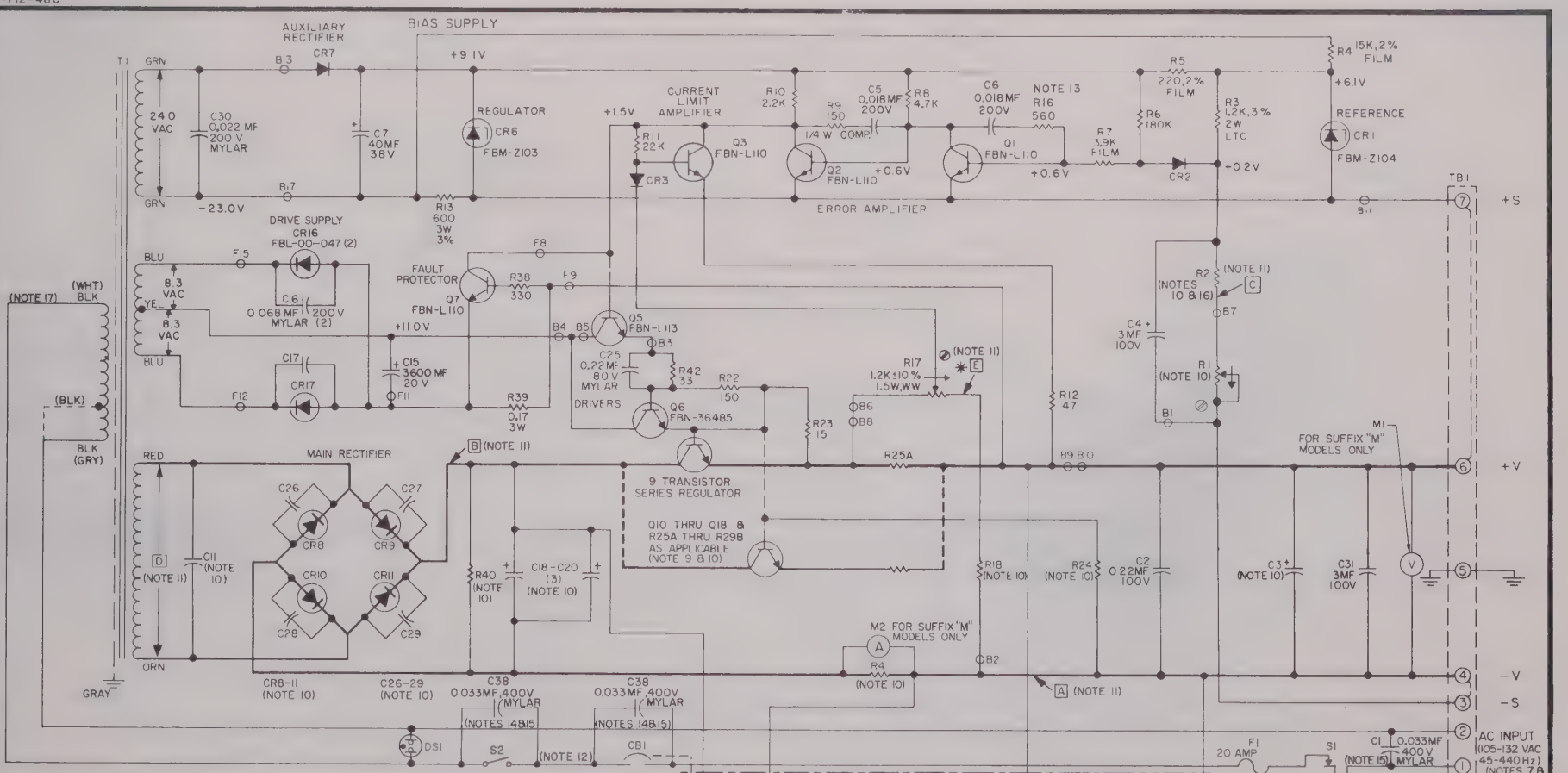
DATA REFERENCES FOR MODELS LM-F2 — LM-F10

Model	Voltage Range (VDC)	Max. Current (Amps)				Schematic Voltage Measurement					Schematic Components							LMOV Subassembly		
		40°C	50°C	60°C	71°C	A (VDC)	B (VDC)	C (VDC)	D (VAC)	E (VDC)	CR8, CR10 (FBL00-)	F1†	R1 5%, 5W	R2 3%, 3W	R18 5%, 1/2W	R24 10%, 2W	R25A, B - R29A, B (Value/Section)	R1 10%, 3/4W	R2 1/2W	R9 10%, 1/2W
LM-F2	2 ±5%	48.0	41.0	33.0	25.0	-2.0	+10.0	-0.965	9.0	-2.0	122	15A (7A)	300	250	Jumper	68	0.18 ± 5%, 11W	2,000	560, 2%	22
LM-F3	3±5%	48.0	42.0	34.0	25.0	-3.0	+9.0	-2.1	9.0	-3.0	122	15A (7A)	300	430	Jumper	68	0.18±5%, 11W	2,000	560, 2%	22
LM-F3P3	3.3±5%	48.0	42.0	34.0	25.0	-3.3	+8.7	-2.1	9.0	-3.3	122	15A (7A)	600	430	Jumper	68	0.18±5%, 11W	2,000	560, 2%	22
LM-F3P6	3.6±5%	48.0	42.0	34.0	25.0	-3.6	+8.4	-2.1	9.0	0.0	122	15A (7A)	600	430	Jumper	68	0.18±5%, 11W	2,000	560, 2%	22
LM-F4	4±5%	48.0	42.0	34.0	25.0	-4.0	+9.0	-3.0	9.7	-4.0	122	15A (7A)	600	600	Jumper	68	0.18±5%, 11W	2,000	560, 2%	22
LM-F4P5	4.5±5%	48.0	42.0	34.0	25.0	-4.5	+8.5	-3.2	9.7	-3.4	122	15A (7A)	600	650	390	68	0.18±5%, 11W	2,000	560, 2%	22
LM-F5	5±5%	48.0	41.0	33.0	25.0	-5.0	+8.0	-3.2	9.7	-2.4	122	20A (10A)	600	650	1,300	68	0.18±5%, 11W	2,000	560, 2%	22
LM-F6	6±5%	47.0	40.0	32.0	24.0	-6.0	+9.0	-4.0	11.1	-2.9	122	20A (10A)	600	800	1,300	180	0.18±5%, 11W	2,000	560, 2%	22
LM-F8	8±5%	44.0	37.0	30.0	23.0	-8.0	+9.0	-6.0	12.5	-2.7	059	20A (10A)	1,000	1,200 2W	2,400	180	0.18±5%, 11W	5,000	1470, 1%	68
LM-F10	10±5%	38.0	33.0	27.0	21.0	-10.0	+8.8	-6.0	13.8	-3.3	059	20A (10A)	2,200	1,200 2W	2,400	180	*0.30±5%, 11W 0.18±5%, 11W	5,000	1470, 1%	68

*This part only used on units with serial No. prefixes A and B.

†Fuse ratings in parenthesis apply to units with "V" option.

SCB-F12-48C



MODELS
LM-F12
LM-F15
LM-F20
LM-F24
LM-F28
LM-F36
LM-F48
LM-F18

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS.

DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIXES A-F

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

NOTES

1. RESISTOR VALUES ARE IN OHMS.
2. RESISTOR WATTAGE 1/2 WATT; RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED.
3. RESISTOR TOLERANCES: COMP. ±10%; WIREWOUND ±5%; FILM ±5%; UNLESS OTHERWISE NOTED.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10%,+100%; MYLAR ±10%; UNLESS OTHERWISE NOTED.
5. SYMBOLS:
   - ↟ INDICATES CLOCKWISE ROTATION OF SHAFT.
   - ⊘ INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - ⏚ INDICATES CONNECTION TO CHASSIS.
   - ▭ INDICATES ACTUAL UNIT MARKING
   - ✱ SEE INSTRUCTION MANUAL.
   - ⊣⊢ LAMBDA PT. #FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - ⊸ INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD
6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
7. DELETE 40° RATING FOR 45-55 Hz, FOR 360-440 Hz, CONSULT FACTORY
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60CPS; OUTPUT: NOM'L VDC NO LOAD INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM. 7) & INDICATED POINTS UNLESS NOTED.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.
10. SEE TABLE I FOR COMPONENT VALUES
11. SEE TABLE I FOR VOLTAGE VALUES
12. CB1 REPLACES S2 IN SUFFIX "OV" MODELS
13. R16 IS 240 OHMS ± 2%, 1/2 W FILM ON MODEL LM-F28.
14. C38 NOT USED ON UNITS WITH SERIAL NO PREFIXES A-D.
15. ON UNITS WITH "V" OPTION, C1 & C38 ARE 0.01 MF ±10%, 1000V, PAPER AND F1 IS 10A
16. R2 IS REPLACED BY A JUMPER ON UNITS WITH "S" OPTION
17. ON UNITS WITH "V" OPTION, T1 HAS TAPPED PRIMARY WIRE COLORS ARE SHOWN IN PARENTHESIS. "V" OPTION UNITS CAN BE WIRED FOR 187-242V INPUT (USING TAP) OR FOR 205-265V INPUT (USING ENTIRE PRIMARY). ON SERIAL NO. PREFIXES A-E, "V" OPTION UNITS: T1 PRIMARY IS NOT TAPPED, PRIMARY WIRES ARE BLK AND AC INPUT IS 205-265V

LAMBDA ELECTRONICS
MELVILLE NEW YORK
DIVISION OF VECO INSTRUMENTS INC.

TABLE 1

DATA REFERENCES FOR MODELS LM-F12— LM-F48

Model	Voltage Range (VDC)	Max. Current (Amps)				Schematic Voltage Measurement					Schematic Components										
		40°C	50°C	60°C	71°C	A (VDC)	B (VDC)	C (VDC)	D (VAC)	E (VDC)	C3	C11	C18-C20	C26-C29	CR8-CR11 (FBLOO-)	Q10-Q18 (FBN-)	R1 5%, 5W	R2 3%, 2W	R18 5%, 1/2W	R24 10%, 2W	R25A, B - R29A, B (Value/Section)	R40 10%, 2W
LM-F12	12±5%	33.0	28.0	22.0	17.0	-12.0	+12.0	-9.0	18.0	-4.0	14000MF, 35V 60V SURGE	1.0MF ±20% 200V	14000MF, 35V 60V SURGE	1.0MF±20% 200V	122	36972	2200	1800	2400	180	0.30±5%, 11W	1000
LM-F15	15±5%	28.0	24.0	19.0	16.0	-15.0	+13.0	-9.0	20.8	-5.0	14000MF, 35V 60V SURGE	1.0MF ±20% 200V	14000MF, 35V 60V SURGE	1.0MF±20% 200V	122	36485	2200	1800	2400	470	0.47±5%, 8W	1000
LM-F18	18±5%	25.0	22.0	18.0	14.0	-18.0	+12.8	-12.5	22.8	-2.7	14000MF, 35V 60V SURGE	1.0MF ±20% 200V	14000MF, 35V 60V SURGE	1.0MF±20% 200V	122	36220	2200	2500	6800	470	0.47±5%, 8W	1000
LM-F20	20±5%	23.0	20.0	17.0	13.0	-20.0	+13.8	-12.5	24.9	-3.0	14000MF, 35V 60V SURGE	1.0MF ±20% 200V	14000MF, 35V 60V SURGE	1.0MF±20% 200V	083	36220	2200	2500	6800	470	0.47±5%, 8W	1000
LM-F24	24±5%	20.0	17.0	14.0	11.0	-24.0	+17.7	-18.0	30.5	-3.6	7800MF, 60V 100V SURGE	1.0MF±20% 200V	7800MF, 60V 100V SURGE	1.0MF±20% 200V	083	36220	2200	3600	6800	1000	0.75±5%, 8W	5600
LM-F28	28±5%	19.0	16.0	13.0	10.0	-28.0	+17.6	-22.5	33.2	-4.2	7800MF, 60V 100V SURGE	1.0MF ±20% 200V	7800MF, 60V 100V SURGE	1.0MF±20% 200V	083	36220	2200	4500	6800	1000	0.75±5%, 8W	5600
LM-F36	36±5%	13.0	11.0	10.0	7.5	-36.0	+19.5	-28.0	40.2	-3.9	7800MF, 60V 100V SURGE	0.15MF ±20% 400V	7800MF, 60V 100V SURGE	0.15MF ±20% 400V	083	36487	3300	5600	10,000	1000	0.75±5%, 8W	5600
LM-F48	48±5%	10.0	9.0	7.5	6.0	-48.0	+27.0	-40.0	54.0	-5.2	3000MF, 100V 150V SURGE	0.15MF ±20% 400V	3000MF, 100V 150V SURGE	0.15MF ±20% 400V	083	36487	3300	8000	10,000	1500	1.5±5%, 8W	5600

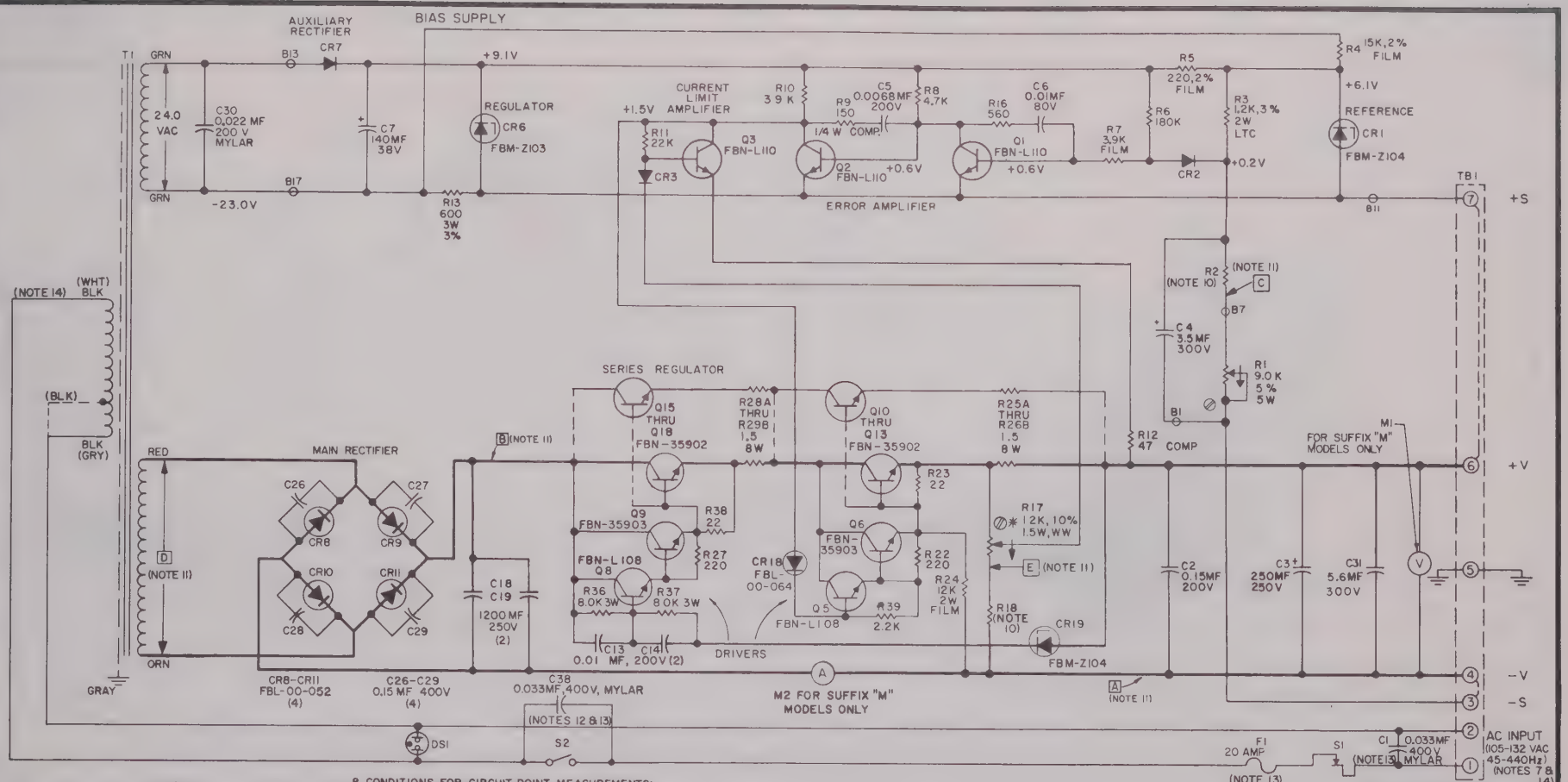
TABLE I (Cont'd.)

DATA REFERENCES FOR MODELS LM-F12 — LM-F48

Model	Schematic Components (Cont'd.)						
	R41 Meter Shunt	R71	LMOV Subassembly				
			Q2 (FBN-)	R1 10%, 3/4W	R2	R7 5%, 1/4W	R9 10%, 1/2W
LM-F12	50A	2.0±3% 3W	L103	5000	1470±1% 1/2W	33	68
LM-F15	30A	2.0±3% 3W	L103	5000	1470±1% 1/2W	33	68
LM-F18	30A	2.0±3% 3W	L114	20,000	4700±2% 1/2W	39	220
LM-F20	30A	2.0±3% 3W	L114	20,000	4700±2% 1/2W	39	220
LM-F24	* 20A	2.0±3% 3W	L114	20,000	4700±2% 1/2W	39	220
LM-F28	* 20A	5.0±5% 5W	L114	20,000	4700±2% 1/2W	39	220
LM-F36	Not Used	5.0±5% 5W	L114	20,000	4700±2% 1/2W	39	220
LM-F48	Not Used	10.0±5% 5W	L114	20,000	4700±2% 1/2W	39	220

*R41 NOT USED ON UNITS WITH SERIAL NO. PREFIXES A-C

SCB-F100-150A



NOTES

1. RESISTOR VALUES ARE IN OHMS.
2. RESISTOR WATTAGE 1/2 WATT; RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED.
3. RESISTOR TOLERANCES: COMP. ±10%; WIREWOUND ±5%; FILM ±5%; UNLESS OTHERWISE NOTED.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10%,+100%; MYLAR ±10%; UNLESS OTHERWISE NOTED.
5. SYMBOLS:
   - INDICATES CLOCKWISE ROTATION OF SHAFT.
   - INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - INDICATES CONNECTION TO CHASSIS.
   - INDICATES ACTUAL UNIT MARKING
   - SEE INSTRUCTION MANUAL.
   - LAMBDA PT. #FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD
6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
7. DELETE 40° RATING FOR 45-55 Hz, FOR 360-440 Hz, CONSULT FACTORY.
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60Hz, OUTPUT: NOML VDC NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM. 7) & INDICATED POINTS UNLESS NOTED.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.
10. SEE TABLE I FOR COMPONENT VALUES.
11. SEE TABLE I FOR VOLTAGE VALUES.
12. C38 NOT USED ON UNITS WITH SERIAL NO. PREFIXES A-D.
13. ON UNITS WITH "V" OPTION, C1 & C38 ARE 0.01MF±10%, 1000V, PAPER AND F1 IS 10A.
14. ON UNITS WITH "V" OPTION, T1 HAS TAPPED PRIMARY. WIRE COLORS ARE SHOWN IN PARENTHESIS. "V" OPTION UNITS CAN BE WIRED FOR 187-242V INPUT (USING TAP) OR FOR 205-265V INPUT (USING ENTIRE PRIMARY). ON SERIAL NO. PREFIXES A-E, "V" OPTION UNITS: T1 PRIMARY IS NOT TAPPED, PRIMARY WIRES ARE BLACK, AND AC INPUT IS 205-265V.

MODELS
LM-F100
LM-F120
LM-F150

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS.

DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIXES A-F

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

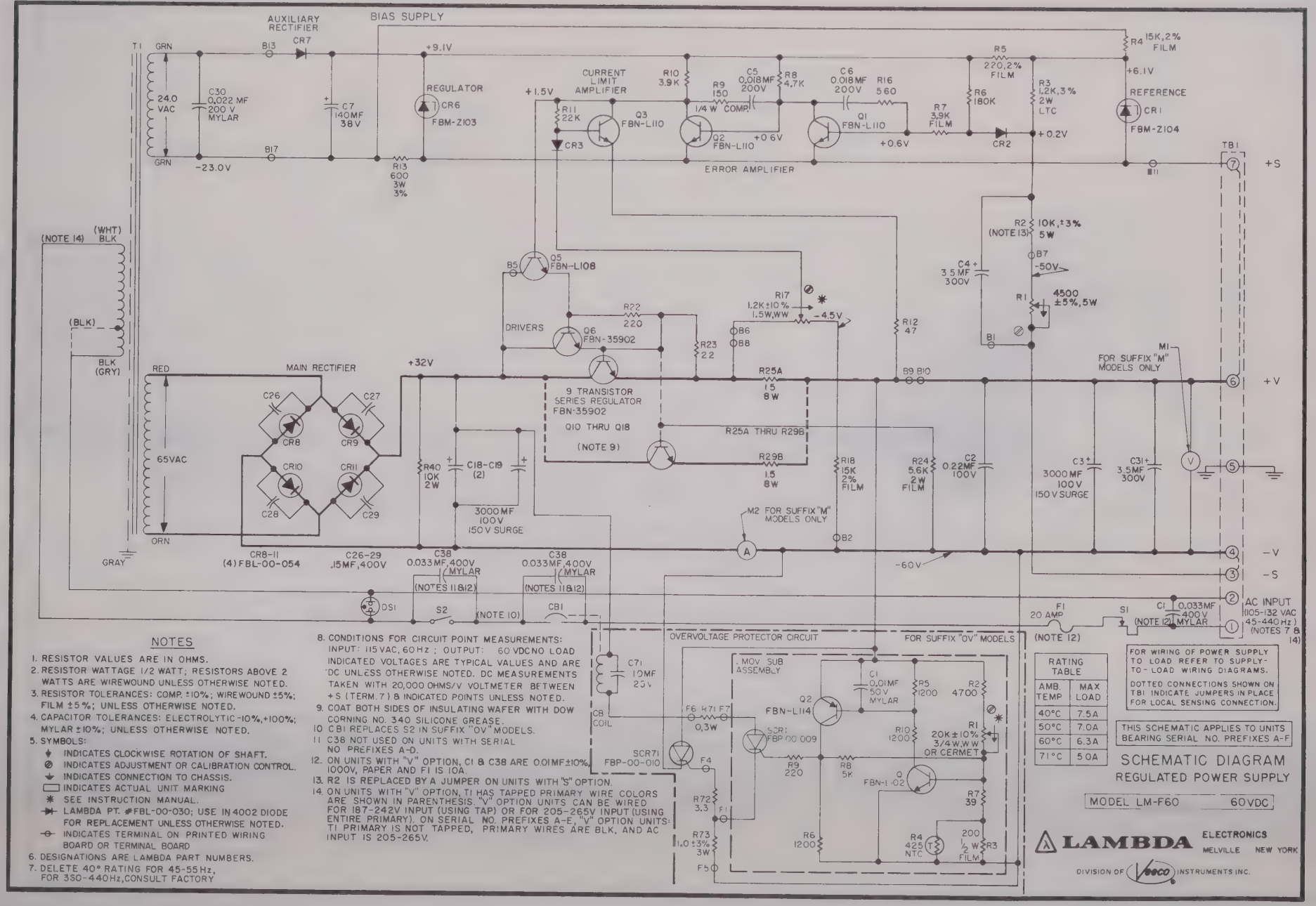
LAMBDA ELECTRONICS
MELVILLE NEW YORK
DIVISION OF Veeco INSTRUMENTS INC.

TABLE I

DATA REFERENCES FOR MODELS LM-F100, LM-F120, LM-F150

Model	Voltage Range (VDC)	Max. Current (Amps)				Schematic Voltage Measurement					Schematic Components	
		40°C	50°C	60°C	71°C	A (VDC)	B (VDC)	C (VDC)	D (VAC)	E (VDC)	R18 5%	R2 3%, 5W
LM-F100	100±5%	4.3	3.6	3.0	2.3	-100	+60	-80	114	-3.0	39K, 1/2W	16K
LM-F120	120±5%	3.7	3.1	2.6	1.9	-120	+70	-100	132	-3.0	43K, 1/2W	20K
LM-F150	150±5%	3.1	2.6	2.1	1.6	-150	+75	-130	162	-3.0	56K, 1W	26K

SCB-F60A



NOTES

1. RESISTOR VALUES ARE IN OHMS.
2. RESISTOR WATTAGE 1/2 WATT; RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED.
3. RESISTOR TOLERANCES: COMP. ±10%; WIREWOUND ±5%; FILM ±5%; UNLESS OTHERWISE NOTED.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10%,+100%; MYLAR ±10%; UNLESS OTHERWISE NOTED.
5. SYMBOLS:
   - ♦ INDICATES CLOCKWISE ROTATION OF SHAFT.
   - ⊘ INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - ⏚ INDICATES CONNECTION TO CHASSIS.
   - ▭ INDICATES ACTUAL UNIT MARKING
   - ✱ SEE INSTRUCTION MANUAL.
   - ⊣▸⊢ LAMBDA PT. #FBL-00-030; USE IN 4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - ⊸ INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD
6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
7. DELETE 40° RATING FOR 45-55 Hz, FOR 350-440 Hz, CONSULT FACTORY
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60 Hz ; OUTPUT: 60 VDC NO LOAD INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM. 7) & INDICATED POINTS UNLESS NOTED.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.
10. CB1 REPLACES S2 IN SUFFIX "OV" MODELS.
11. C38 NOT USED ON UNITS WITH SERIAL NO PREFIXES A-D.
12. ON UNITS WITH "V" OPTION, C1 & C38 ARE 0.01MF±10%, 1000V, PAPER AND F1 IS 10A.
13. R2 IS REPLACED BY A JUMPER ON UNITS WITH "S" OPTION.
14. ON UNITS WITH "V" OPTION, T1 HAS TAPPED PRIMARY WIRE COLORS ARE SHOWN IN PARENTHESIS. "V" OPTION UNITS CAN BE WIRED FOR 187-242V INPUT (USING TAP) OR FOR 205-265V INPUT (USING ENTIRE PRIMARY). ON SERIAL NO. PREFIXES A-E, "V" OPTION UNITS: T1 PRIMARY IS NOT TAPPED, PRIMARY WIRES ARE BLK, AND AC INPUT IS 205-265V.

RATING TABLE	
AMB. TEMP	MAX LOAD
40°C	7.5A
50°C	7.0A
60°C	6.3A
71°C	5.0A

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS.

DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

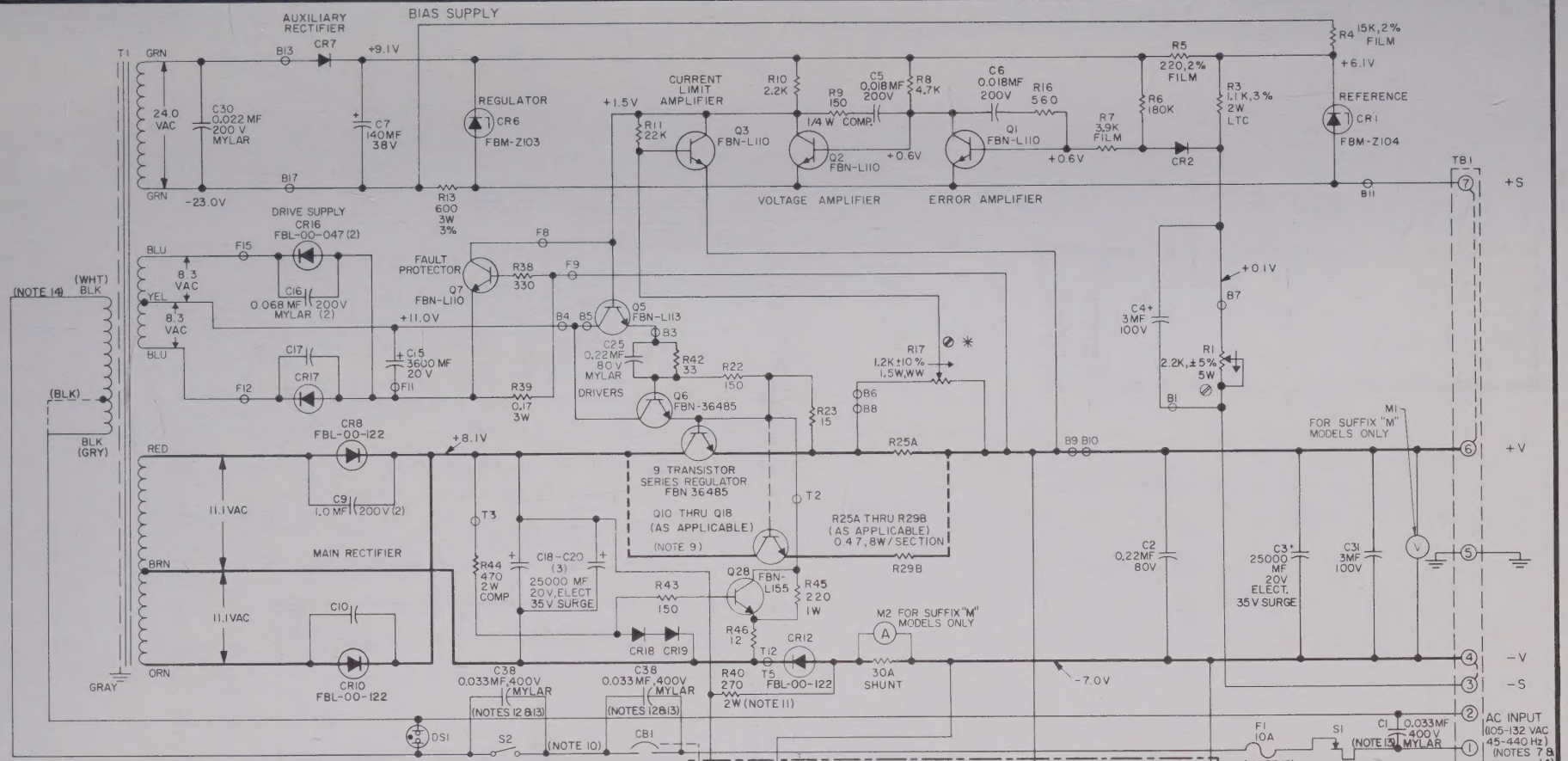
THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIXES A-F

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

MODEL LM-F60 60VDC

LAMBDA ELECTRONICS MELVILLE NEW YORK
DIVISION OF Vaco INSTRUMENTS INC.

SCB-FO-7



NOTES

1. RESISTOR VALUES ARE IN OHMS.
2. RESISTOR WATTAGE 1/2 WATT; RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED.
3. RESISTOR TOLERANCES: COMP. ±10%; WIREWOUND ±5%; FILM ±5%; UNLESS OTHERWISE NOTED.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10%,+100%; MYLAR ±10%; UNLESS OTHERWISE NOTED.
5. SYMBOLS:
   - INDICATES CLOCKWISE ROTATION OF SHAFT.
   - INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - INDICATES CONNECTION TO CHASSIS.
   - INDICATES ACTUAL UNIT MARKING
   - SEE INSTRUCTION MANUAL.
   - LAMBDA PT. #FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD.
6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
7. DELETE 40° RATING FOR 45-55 Hz, FOR 360-440Hz, CONSULT FACTORY.
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60 Hz , OUTPUT: 7.0 VDC NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM. 7) & INDICATED POINTS UNLESS NOTED.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.
10. CB1 REPLACES S2 IN SUFFIX "OV" MODELS.
11. R40 NOT USED ON UNITS WITH SERIAL NO. PREFIXES A-C.
12. C38 NOT USED ON UNITS WITH SERIAL NO. PREFIXES A-D.
13. ON UNITS WITH "V" OPTION, C1 & C38 ARE 0.01MF±10%, 1000V, PAPER AND F1 IS 7A.
14. ON UNITS WITH "V" OPTION, T1 HAS TAPPED PRIMARY. WIRE COLORS ARE SHOWN IN PARENTHESIS. "V" OPTION UNITS CAN BE WIRED FOR 187-242V INPUT (USING TAP) OR FOR 205-265V INPUT (USING ENTIRE PRIMARY). ON SERIAL NO. PREFIXES A-E, "V" OPTION UNITS: T1 PRIMARY IS NOT TAPPED, PRIMARY WIRE COLORS ARE BLK, AND AC INPUT IS 205-265V.

RATING TABLE	
AMB. TEMP	MAX LOAD
40°C	25.0A
50°C	21.0A
60°C	17.0A
71°C	14.0A

REF. DES.
NOT USED
C8, C12-C14
C21-C24
CR3-CR5
CR9, CR11
CR13-CR15
R2, R12, R14
R15, R18-R21
R24, R30-37
C26-C29
Q4, Q8, Q9
Q19-Q27

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS.

DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIXES A-F

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

MODEL LMF-0-7 7 VDC

LAMBDA ELECTRONICS
MELVILLE NEW YORK
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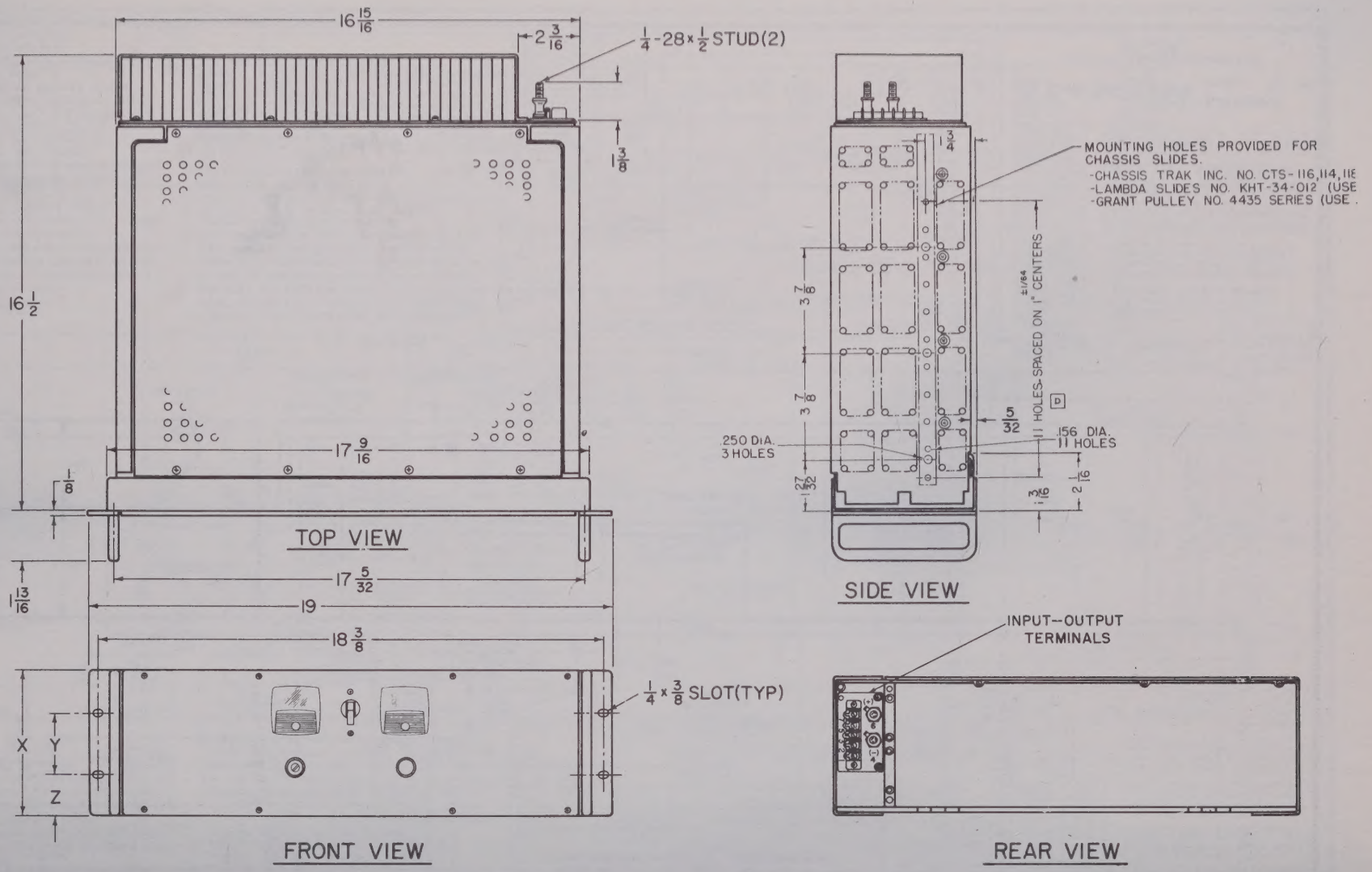
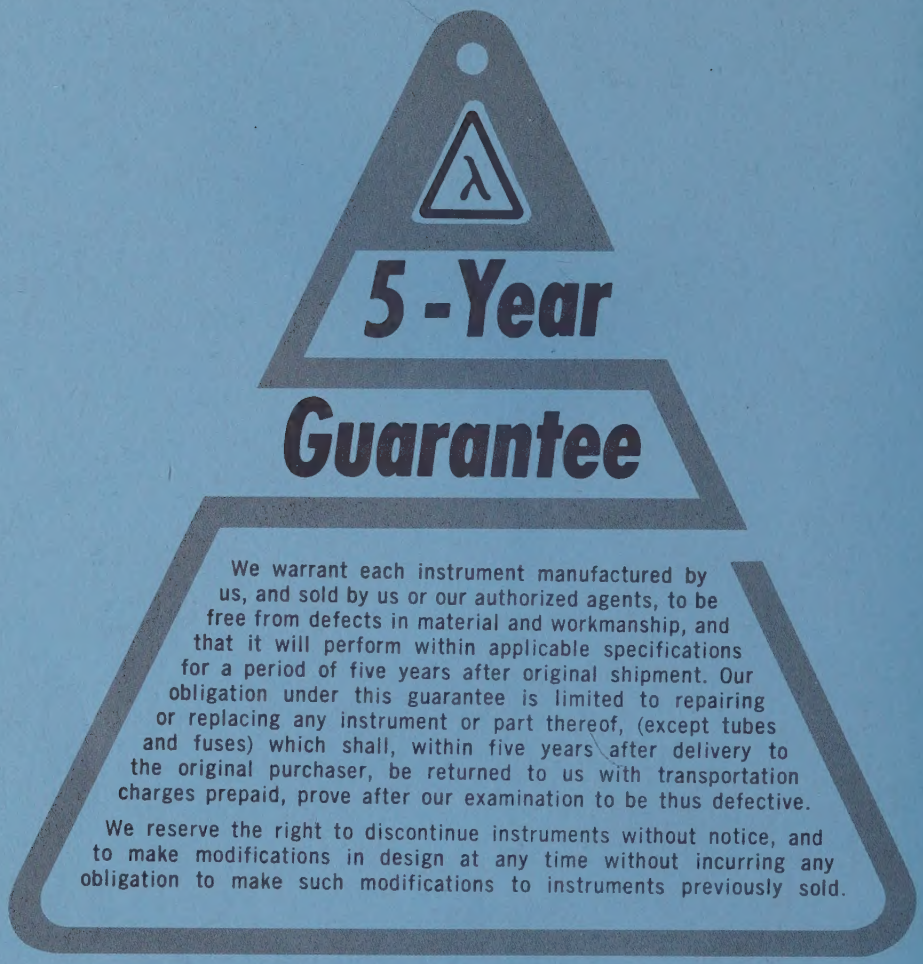


Outline Drawing


5-Year
Guarantee
We warrant each instrument manufactured by us, and sold by us or our authorized agents, to be free from defects in material and workmanship, and that it will perform within applicable specifications for a period of five years after original shipment. Our obligation under this guarantee is limited to repairing or replacing any instrument or part thereof, (except tubes and fuses) which shall, within five years after delivery to the original purchaser, be returned to us with transportation charges prepaid, prove after our examination to be thus defective.
We reserve the right to discontinue instruments without notice, and to make modifications in design at any time without incurring any obligation to make such modifications to instruments previously sold.

LAMBDA ELECTRONICS
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